Lowell City Council
Work Session Agenda
Tuesday, July 16 at 6:30 P.M.
Maggie Osgood Library
70 North Pioneer Street, Lowell, OR 97452

Call to Order/Roll Call

Councilors: Mayor Bennett ____ Angelini ____ Harris ____ Stratis ____ Dragt ____

Work Session Topic(s)

1. Pavement Preservation Plan

Adjourn

The meeting location is accessible to persons with disabilities. A request for an interpreter for the hearing impaired or for other accommodations for persons with disabilities should be made at least 48 hours before the meeting to Joyce Donnell at 541-937-2157.

Civil West Engineering Services, Inc.

CITY OF LOWELL

Pavement Preservation Plan

March 2019

REGISTERED PROFESSIONAL ENGINEER
83524PE
OREGON
NOV. 10, 2009
MATTHEW D. WADLINGTON

EXPIRATION DATE: 06/30/2020

www.civilwest.com | Willamette Valley | South Coast | North Coast | Rogue Valley

CONTENTS

1 INTRODUCTION

1.1 INTRODUCTION

The City of Lowell is located 19 miles southeast of Springfield and Interstate 5, in Lane County, Oregon. The City has provided roadways to its residents and travelers since the mid-1900's when the Highway Commission and Forest Services worked together to survey and build the Lakeview Burns Highway No. 18, currently known as Highway 58, passing the southern edge of the City of Lowell. In 1907 the Lowell Covered Bridge was built connecting the community to the surrounding areas. This bridge was used to pass over the Middle Fork of the Willamette River.

Today, the City's transportation system has approximately 5 miles of paved roads, which the City maintains. Most of the roadway consists of local and minor-collector roads providing access to residential properties. Some elements of the road facilities include sidewalks, roadside ditches, storm drains, traffic control signage, and pavement markings.

The population in the City of Lowell is 1,115 people as of 2017.

1.2 STUDY DESCRIPTION

This study uses geotechnical investigative and observatory methods to determine the pavement condition and to develop a pavement preservation plan. This plan will identify where improvements are needed, provide cost estimates, and provide financial overview that will address the current pavement deficiencies and plan for future projects. These projects have been outlined in the capital improvement plan (CIP), in section 7 of this report. See figure 1-1 for an overview of the roadway system and project locations.

The City has hired Civil West Engineering Services, Inc. to complete this Pavement Preservation Plan. Civil West has worked alongside Carlson Testing, Inc. to complete limited geotechnical investigation to better asses the structural integrity of the pavement throughout the City of Lowell.

1.3 PROJECT OVERVIEW

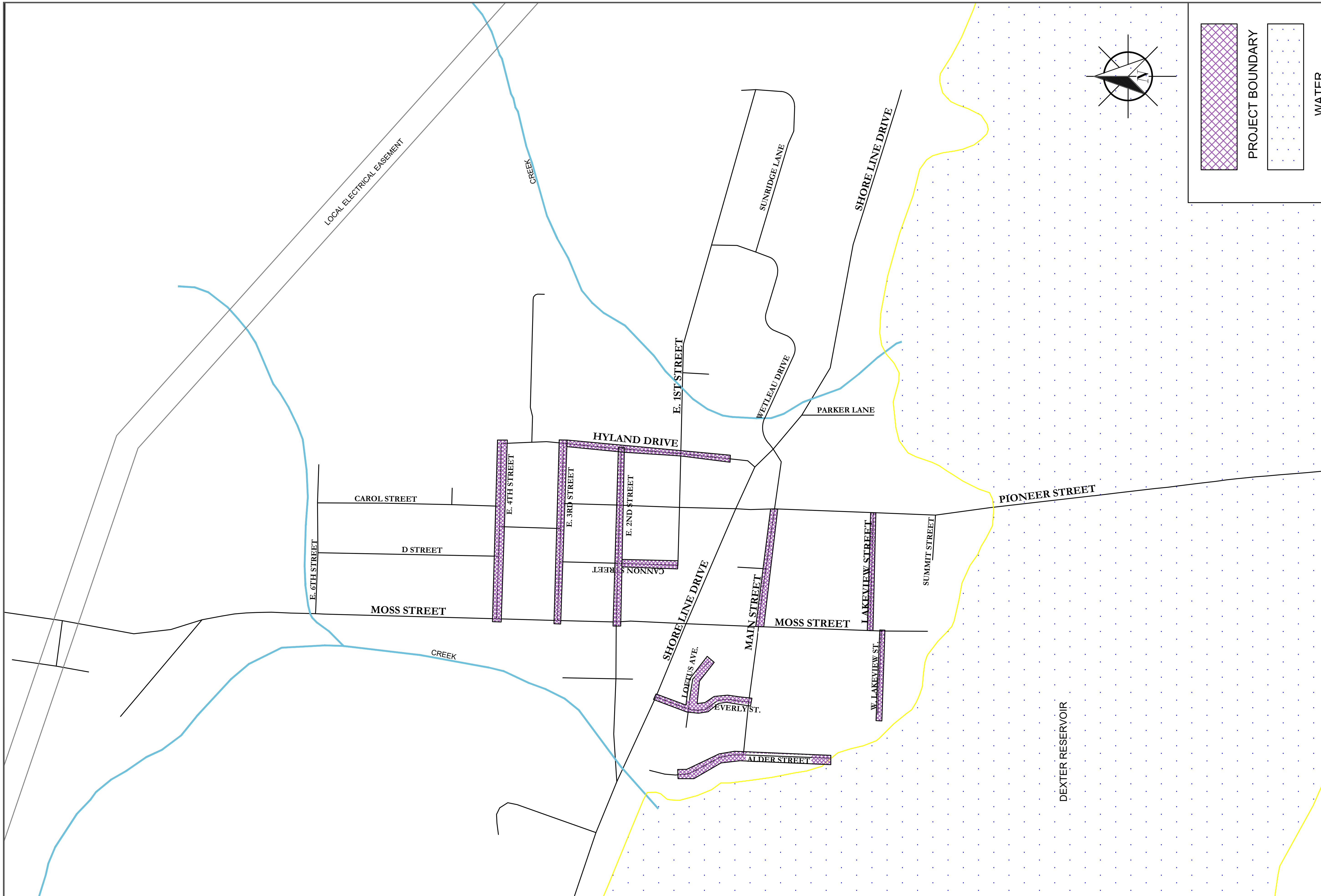
This plan identifies 9 pavement preservation projects that include full or partial sections of 10 different streets throughout the City. Pavement projects consist of crack sealing, slurry seal, patching, grind and overlays, and pavement replacement. Project 9 specifically identifies the annual cost of maintenance that should be budgeted to maintain the roadways.

1.4 SUMMARY OF CAPITAL IMPROVEMENT PLAN

Recommendations in section 6 of this Plan have been prioritized in the CIP to help the City determine which projects should be completed each year to effectively maintain the transportation system of Lowell.

The total cost to complete all projects included in the CIP is estimated to be **$896,054.29**. This estimate does not include the annual maintenance cost.

In addition to these projects the City should plan for the future. The annual cost determined to be able to maintain the roadways and pavement condition within the city is **$265,439.52** per year.



Civil West Engineering Services, Inc.

CITY OF LOWELL
LANE COUNTY, OR

ROADWAY MAP

0 1"
NTS

DRAWN BY: MKC
DATE: JANUARY 2019

FIGURE
1-1

2 HISTORY AND NEED

2.1 HISTORY AND NEED FOR THIS PROJECT

Most of the streets within the City of Lowell have very low traffic loads and there has been minimal maintenance completed to preserve the life of the pavement. This has left the City with roads that are starting to show signs of deterioration and failure. The standard road is expected to last 20-30 years before it is recommended to be rebuilt entirely. To extend the life of the pavement the City would need to complete preventative maintenance. Section 4 in this report outlines the maintenance methods most typically used and when.

The local streets surrounding the public schools are the most heavily used and some sections are not equipped to handle two-way traffic, pedestrians, and street parking. Some of the roads are suspected to have been constructed with limited base and subbase layers. Since there are no record drawings or as-built information on the City streets, some locations will require geotechnical investigations.

3 DISTRESS IN ASPHALT PAVEMENT

3.1 INTRODUCTION

This section will discuss the different types of pavement distress and failure. Since there are many types of pavement distress, this report will only discuss the most commonly observed throughout the City of Lowell or that are the most typically seen. This section will also define some common terms related to pavement.

Oxidation is a polar bonding molecular process that occurs when asphalt is exposed to oxygen. Over time molecular bonds harden and the pavement becomes brittle. Oxidized pavement will experience a loss of elasticity and increase the probability of failure. The pavement color will also change during this process, black to grey in color as oxidation becomes more apparent. Once the pavement is brittle, cracks begin to form causing base weakening, fatigue and failure.

Base weakening is caused when surface water leaks in to the cracks of the pavement. This allows water to enter the base and sub-base layers, reducing the pavement structural capacity. This will increase the load applied to the pavement and the result is fatigued pavement.

Fatigue occurs when water has entered the pavement sub-base layers through open cracks in the pavement surface or sub-surface layers. Fatigue is accelerated when the water present and the pavement is forced to take on more loading then designed for due to the base weakening. This is also referred to as alligator cracking as described more in section 3.2.1.

Failure occurs after fatigue and is caused by continuous weather conditions, traffic loading and movement in the pavement. After time the base layers will begin to show. This is called pavement failure.

3.2 CRACKING

3.2.1 ALLIGATOR CRACKING

Alligator or "fatigue" cracking is a series of interconnected cracks caused by repeated traffic loading to the pavement surface. The cracks begin at the bottom layer of the pavement and eventually make their way to the surface. This allows for water to penetrate the base and sub-base layers of the pavement, causing more distress. The cracks reach the pavement surface, initially as parallel longitudinal cracks. After repeated loading, the cracks make connections to form a pattern resembling alligator skin. The cracked pieces of pavement are usually less than 1.5 feet on the longest side.

Figure 3-1 Alligator Cracking on Main St.

Alligator cracking is caused by traffic loading, poor sub-base or base structure, and aging pavement.

Typical treatment methods include: patching, 2" hot mix overlay, and chip seal. In low severity cases slurry seal or fog sealing may be recommended.

3.2.2 EDGE CRACKING

Edge cracking is a section of parallel cracks to the pavement edge. Typically seen within 1 to 1.5 feet of the outer edge of the pavement. This pavement distress is associated with traffic loading, weakened base or subgrade caused by frost heave or thaw weakening. Edge cracking at a high-severity can be classified as raveling (see section 3.2 below for more information on raveling). These cracks usually range from 1/8-inch to greater than ¼-inch.

Figure 3-2 Edge Cracking on 2nd St.

Edge cracking is caused by traffic loading, environment, poor construction methods, and pavement shoulder deficiencies.

Typical treatment methods include: crack sealing, cold mix overlay, and shoulder maintenance/reconstruction.

3.2.3 LONGITUDINAL AND TRANSVERSE CRACKING

Longitudinal cracking is parallel to the pavement's centerline. Cracking may be seen anywhere along the pavement in the parallel direction. Severe longitudinal cracking can be classified as alligator cracking. Longitudinal cracks can be anywhere from 3/8-inch to 3-inches in width.

Transverse cracking are cracks that are formed in right angles or perpendicular from the pavement centerline. These cracks vary in size, ranging from ¼-inch to 2-inches in width. Transverse cracking is not caused by traffic loading.

Figure 3-3 Longitudinal Cracking on Main St.

Longitudinal and Transverse cracks are usually caused by environmental impacts (freeze and thaw), swelling or shrinkage of the subgrade, poor construction methods, settlement, poor drainage and reflections cracks (cracks that occur on an overlay over an exciting crack).

Typical treatment methods include crack sealing, chip seal, or patching.

3.2.4 BLOCK CRACKING

Block cracking is connected cracks creating rectangular or square cracked sections. These cracks range from an area of the size 1 by 1-foot to 10 by 10-foot sections. Block cracking is caused by the shrinkage of the asphalt and temperature change.

Block cracking is not caused by traffic loading. Block cracking is caused by environmental conditions and aging pavement.

Typical treatment methods include crack sealing, fog sealing, slurry seal, chip seal, or overlay.

Figure 3-4 Block Cracking (not in Lowell)

3.3 RAVELING

Raveling also is known as "weathering", is the wearing of the pavement binder on the surface. Climate conditions can accelerate the loss of binder and aggregates. New pavement can see raveling start to occur in as little as 6 months after pavement construction due to poor construction methods (inadequate compaction) or oxidation and erosion (water on the pavement surface). The aggregate may be exposed in the sizes of 0.05-inch in low severity cases to greater than ¼-inch in more severe cases.

Raveling is caused by the loss of asphalt binder due to weather, erosion, aging and daily use.

Typical treatment methods include fog sealing, slurry seal, chip seal, or overlay.

Figure 3-5 Pavement Raveling on Loftus Ave.

3.4 RUTTING

Rutting of the pavement is observed surface depression along the wheel path. This pavement and subgrade deformation are caused by repeated traffic loading and construction method deficiencies. Rutting is more noticeable in rainy weather when standing water can occur. The levels of depression in the wheel path are usually between ½-inch in less severe cases to 2-inches for more severe cases.

Rutting is caused by repeated traffic loading.

Typical treatment methods include milling and overlay.

Figure 3-6 Pavement Rutting (not in Lowell)

4 PAVEMENT PRESERVATION METHODS

4.1 INTRODUCTION

There are a variety of rehabilitation methods depending on the severity of the pavement conditions. This section will discuss pavement preservation methods, how the process is completed when to use each method and the cost effectiveness for each option.

4.2 CRACK SEALING

This treatment involves cleaning cracks (over 1/8" wide) using a "hot air lance" to blow out debris, burn grass and weeds, and dry the crack. Cracks should be 1/8" – 1" in size for crack sealing to be recommended. Immediately after cleaning, the crack is filled with a specialized elastomeric sealing compound. The elastomeric sealant has a low modulus of elasticity and will stretch easily. The compound has a high durability and can last up to 4 years. Regular traffic can be allowed 5 minutes after the application. This method is recommended for pavement with longitudinal, transverse, and block cracking. Benefits of crack sealing include: preventing water from entering the base and subgrade, preventing debris from entering the cracks, and preparing the road for overlay or other maintenance treatments. Crack sealing is a cost-effective way to treat roads with minimal deterioration.

4.3 SLURRY SEAL

This is a treatment using a mixture of water, asphalt emulsion, and aggregate to the existing pavement. The combined mixture represents a slurry. Additives like latex polymer are commonly added to the asphalt emulsion. Placing the mixture over existing pavement is called a seal. Typically, applications are on residential streets and can last up to 7 years. A slurry truck designed with multiple compartments to hold and mix the water, asphalt emulsion, aggregate, and additives. The slurry mixture is dispersed out of the back of the truck. The slurry is then smoothed out on the surfaces with a squeegee. The slurry seal sets within 4 to 6 hours and is ready for regular traffic. This pavement preservation method seals cracks, restores flexibility to pavement surface and helps to preserve the underlying pavement structure. It also has an appealing uniform dark black color. This method is recommended for pavement with moderate distress, no rutting, and narrow crack widths and is usually completed on an intermittent or recurrent basis.

4.4 CHIP SEAL

This treatment method requires a two-step process, first applying a layer of asphalt emulsion and then a layer of crushed rock to the existing surface. The asphalt emulsion usually contains additives like latex polymer and a rejuvenating agent. A distributor truck applies a layer of the asphalt emulsion to seal the existing pavement surface. This is followed by a chip spreader that applies the crushed rock. As the chip spreader travels, a dump truck dumps rock into the spreader. After the chips are spread, a steel drum roller and rubber-tired rollers follow behind for compaction of the application. Chip sealing is usually cycled every 7 to 10 years. This method is recommended for pavement with moderate alligator cracking with no spalling (excess deterioration of cracks) or rutting and where feasible to extend the life of pavement until resurfacing can be performed.

4.5 Asphalt Overlay

This treatment method involves a mix design of hot liquid asphalt and aggregates. This mixture is applied directly to the top of a deteriorating pavement surface. Sometimes asphalt milling may be required prior to the application but is not always necessary. Milling involves removing the top layer of the pavement surface with cracks and raveling damage. A truck is used to apply the asphalt overlay, usually, the overlay is 1.5 to 2 inches in thickness. After the application, compaction is achieved using mechanical rollers with vibration. Usually, traffic can continue 4-6 hours after completion of the application. An asphalt overlay is expected to last 10 to 20 years. This method is recommended for pavement with cracks, raveling, no rutting, or root damage or when a need for regrading is observed.

4.6 Remove and Replace

Remove and replace pavement can be very expensive and is only recommended when there is extensive structural damage and severe deterioration of the pavement surface or the street carries more load then designed for. This will require geotechnical investigative sampling to help determine the best recommendation for the new pavement design. The new pavement design will also consider the traffic loading of the area chosen to remove and replace. This method is expected to last 20 years or more.

4.7 Deep patch

A deep patch is typically recommended on small sections of pavement that exhibit signs of base weakening and fatigue. These areas can be easily corrected by removing the pavement and base layers, then over excavating to provide a decent subbase layer (usually 6-8” of rock) and applying 4-inches of asphalt. This repair method is usually coupled with a slurry seal or grind and overly.

5 ENGINEERING FIELD ANALYSIS & RESULTS

5.1 FIELD DATA AND OBSERVATIONS

Field data was collected by onsite inspection, observation, and core sampling. The City streets were walked, and areas showing pavement distress and deterioration were recorded. The City also identified areas of concern for traffic congestion, off street parking and pavement condition. From observation, many streets were in moderately good condition. Pavement distress most commonly visible throughout the City was raveling, alligator cracking, oxidation, and edge cracking.

5.2 GEOTECHNICAL INVESTIGATIVE METHODS AND RESULTS

Core samples are taken to allow for a visual inspection of the asphalt layer, base and subbase layers. Pavement thickness, drainage and soil type all can be determined to allow for the best improvements or repair method.

The City completed core samples on East Main Street and East Lakeview Street. The results were used to define the structural integrity of the pavement and to make recommendations for rehabilitation. The recommendations provided by the geotechnical engineer have been outlined in project 1, and section 6 of this report. For a full geotechnical report see Appendix A.

6 IMPROVEMENT PROJECTS

6.1 INTRODUCTION

This section discusses in detail, the recommended pavement preservation projects from the combined results of core sampling and observed pavement distress. A cost estimate has been provided along with a drawing showing the location and extents of each project.

6.2 DISCUSSION OF COST ESTIMATES

Once a preferred repair method was chosen, the associated improvements and local area conditions were assessed when developing cost estimates for each repair. The restoration of any existing facility, structure, or landscape was also included in the cost estimates. In addition to individual project costs, estimates include mobilization and temporary control, demo and site prep, contingency, legal/administration fees, and engineering. See below for a brief explanation.

Mobilization and temporary facilities costs are based upon a percentage of the overall project cost. Mobilization usually includes the cost to move and rent equipment along with any one-time costs associated with starting and ending construction. Temporary facilities include items such as fencing, traffic control, restrooms, markers, and erosion control. Some adjustments of these prices have been made to the estimates provided in the next section of the report for associated projects that have specialized equipment cost. This report, otherwise, utilizes a mobilization and temporary control costs of 10% and 5%, respectively.

Contingency costs are intended to account for any unknowns or unforeseen events that may arise. Improvement projects have not included subsurface geotechnical surveys, sewer lateral locations, or easement locations. As the projects continues through the design phase, the number of unknowns will decrease, as will the contingency allowance. This report utilizes a contingency of 20% of the overall construction cost for each project.

Administration costs are a small portion of the overall project cost and include legal fees, City staff costs, cost associated with permitting, internal planning, and any miscellaneous non-construction related work. This report utilizes an administration cost of 5% of the overall construction cost for each project.

Engineering fees are estimated as a percentage of the overall cost of construction. With projects varying in scope and uncertainties, the engineering costs can vary as well. This project utilizes an engineering cost of 20% of the overall cost of construction.

Construction cost estimates in this report are based on recent and similar projects, material costs from suppliers, and special construction costs.

6.3 Pavement Preservation Projects and Recommendations

To address existing deficiencies in the City of Lowell, the following projects have been identified. Please note that some projects include improvements to more than one street, which should be bundled within small geographic locations.

In addition to the specific projects recommended herein, it is recommended that the city develop a budget for annual street improvements to treat or replace pavement as it deteriorates. As described in section 2.2, pavement is expected to last 20 years, if some maintenance is completed during that time period pavement is expected to last 30-40 years. Project 8, at the end of this section is included to develop the annual cost for pavement maintenance.

6.3.1 Project 1

This project is on Main Street. Main Street runs parallel on the northside to the property of the Lowell High School. Main Street was identified by the City as priority projects due to the amount of traffic the street encounter's daily. Observed pavement distress on Main Street includes; severe to moderate alligator cracking, longitudinal cracking, oxidation, aging, and raveling.

Geotechnical investigation, completed July 2018, recommends Main Street be repaired with deep patching in areas of severe alligator cracking combined with a 2-inch grind and overlay of new asphalt pavement. See the project sheet C1 for more information. Below is the overall construction cost estimate for East Main Street improvements totaling **$119,174.88**.

Table 6-1 East Main Street Improvements Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance (10%)	ls	1	$ 6,736.85	$ 6,736.85
2	Construction Facilities & Temporary Controls (5%)	ls	1	$ 3,368.43	$ 3,368.43
3	Demolition & Site Preparation (7%)	ls	1	$ 4,715.80	$ 4,715.80
Demolition					
4	Cold Pane/Grind Pavement Removal (2 inches deep)	sy	2331	$ 3.00	$ 6,992.00
5	Over Excavate Deep Patches 6"	sy	123	$ 25.00	$ 3,066.67
Roadway Improvements					
7	Surface Treatments (seal cracks)	sy	2331	$ 3.00	$ 6,992.00
8	Deep Patching at Driveways (5% of street) includes saw cutting, geo fabric, backfill and AC	ls	1	$ 3,373.33	$ 3,373.33
9	2" AC Pavement Overlay- Level 3	sy	2331	$ 14.00	$ 32,629.33
10	Clean Pavement Surface and Apply Top Coat Per 00730 ODOT	sy	2453	$ 5.00	$ 12,266.67
Striping					
11	12" Thermoplastic 12' Stop Bar and 34' Crosswalk	lf	46	$ 11.00	$ 506.00
12	4" White Dotted Line Per ODOT TM500 WD	lf	695	$ 1.50	$ 1,042.50
13	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Construction Subtotal					$ 82,189.57
Contingency			20%		$ 16,437.91
Engineering			20%		$ 16,437.91
Administrative			5%		$ 4,109.48
Total Project Cost					**$119,174.88**

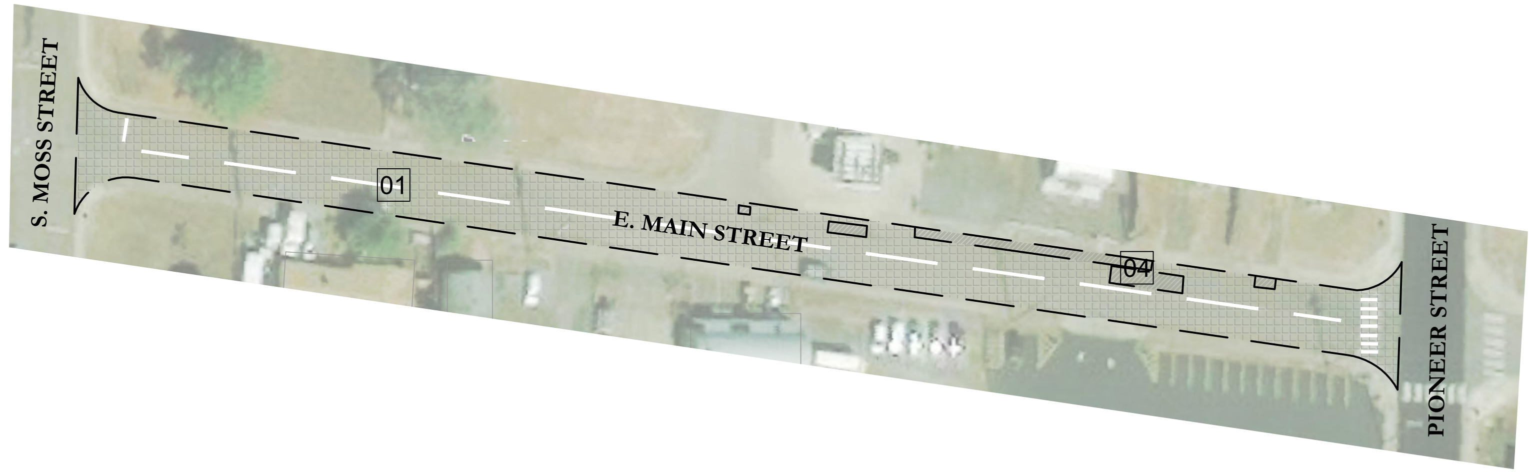
6.3.2 Project 2

This project is on Lakeview Avenue. Lakeview runs parallel on the southside to the property of the Lowell High School. Lakeview was identified by the City as priority projects due to the amount of traffic the street encounter's daily. Observed pavement distress and deficiencies on Lakeview includes; longitudinal cracking, the width of the roadway, and no off-street parking.

Geotechnical investigation, completed July 2018, identified pavement deficiencies including poor sub-base and lack of required pavement thickness for traffic loading. It is recommended Lakeview be repaired with a 2-inch grind and overlay for the ¼ most eastern section of the street and full removal and replacement of the remainder. See the project sheet C1 for more information. Below is the overall construction cost estimate for East Lakeview Avenue improvements totaling **$142,100.82**.

Table 6-2 East Lakeview Avenue Improvements Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$ 8,032.83	$ 8,032.83
2	Construction Facilities & Temporary Controls	ls	1	$ 4,016.42	$ 4,016.42
3	Demolition & Site Preparation	ls	1	$ 5,622.98	$ 5,622.98
	Demolition				
4	Cold Pane/Grind Pavement Removal (2 inches deep) (1/4 most eastern section)	sy	383	$ 3.00	$ 1,150.00
5	Roadway Section Removal (3/4 most western section)	sy	1150	$ 25.00	$ 28,750.00
6	Sawcut existing Concrete, Sidewalks, & Pavement	lf	100	$ 1.90	$ 190.00
	Roadway Improvements				
7	Standard Curb	lf	650	$ 12.00	$ 7,800.00
8	Surface Treatments (Seal cracks)	sy	1533	$ 3.00	$ 4,600.00
9	2" AC Pavement Overlay- Level 3	sy	383	$ 14.00	$ 5,366.67
10	4" AC Pavement - Level 3	sy	1150	$ 14.00	$ 16,100.00
11	6" Aggregate Base	sy	1150	$ 6.00	$ 6,900.00
12	Clean Pavement Surface and Apply Top Coat Per 00730 ODOT	sy	1533	$ 5.00	$ 7,666.67
	Striping				
13	12" Thermoplastic 10' Stop Bar and 18' Crosswalk	lf	30	$ 11.00	$ 330.00
14	4" White Dotted Line Per ODOT TM500 WD	lf	650	$ 1.50	$ 975.00
15	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Construction Subtotal					$ 98,000.57
Contingency			20%		$ 19,600.11
Engineering			20%		$ 19,600.11
Administrative			5%		$ 4,900.03
Total Project Cost					**$142,100.82**



KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

- REMOVE AND REPLACE PAVEMENT
- GRID AND OVERLAY
- TYPE 2 SLURRY SEAL
- DEEP PATCH
- EXTENTS OF PAVEMENT TO BE REHABILLITATED

GENERAL NOTES

1. ATTENTION: OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH 952-001-0090. YOU MAY OBTAIN A COPY OF THE RULES BY CALLING THE CENTER.
2. NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS (503) 232-1987.
   STAT. AUTH.: ORS 757.542 THROUGH ORS 757.562 AND ORS 757.993.
3. THE CONTRACTOR SHALL CONTACT 'ONE CALL' FOR UTILITY LOCATES PRIOR TO EXCAVATION. (1-800-332-2344)
4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
11. TREE ROOTS SHALL BE REMOVED TO THE EXTENTS INSTRUCTED BY THE CITY'S REPRESENTATIVE OR ENGINEER. SAW CUT PAVEMENT AND REMOVE TREE ROOT IN PAVEMENT AREA. REBUILD BASE TO MATCH SURROUNDING.
12. IN REMOVE AND REPLACE SECTIONS OF PAVEMENT, SAW CUT DESIGNATED PERIMETER OF PAVEMENT REMOVAL. REPLACE AGGREGATE BASE SUB-GRADE WITH 6-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. MAKE SMOOTH TRANSITION AT ALL EXISTING PAVEMENT EDGES. MATCH TO EXISTING GRADES.
13. PAVEMENT EDGE REMOVAL WILL CONSIST OF REMOVING 1.5 FEET OF PAVEMENT ALONG THE EDGE OF ROAD WHERE NOTED ON PLANS. DEPTH OF PAVEMENT AND BASE REMOVAL WILL BE 16 INCHES. REPLACE THE BASE WITH 12-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. APPLY TACK COAT TO ALL BITUMINOUS SURFACES PRIOR TO AC PLACEMENT.
14. PROTECT INLETS AND CATCH BASINS IN AND DOWNSTREAM FROM CONSTRUCTION AREAS PRIOR TO WORK.
15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1/C1 LAKEVIEW STREET AND MAIN STREET

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
Coos Bay, Oregon 97420
541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC
Drawn By: MKC
Checked By: MDW
Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

LAKEVIEW STREET AND MAIN STREET

Sheet No. C1

Date NOVEMBER 2018

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

6.3.3 Project 3

This project consists of three streets, Everly Street, Loftus Avenue, and two small sections of Main Street. Everly runs north and south and connects Main Street to N. Shore Drive. Loftus consists of two cul-de-sacs off Everly. Observed pavement distress on Main Street includes; oxidation, aging, and raveling. Observed pavement distress and deficiencies on Everly and Loftus include; longitudinal cracking, oxidation, aging and severe raveling.

It is recommended to complete a 2-inch grind and overlay of new asphalt pavement on the entire section of Loftus and Everly and on the most western portion of Main with a remove and replace on the eastern section. Before the overlay, it is recommended to seal all existing cracks in the pavement. See the project sheet C2 for more information. Below is the overall construction cost estimate for Everly, Loftus and West Main Street improvements totaling **$166,245.21,** including geotechnical investigation.

Table 6-3 Everly and Main Street Improvements Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$9,115.05	$ 9,115.05
2	Construction Facilities & Temporary Controls	ls	1	$4,557.52	$ 4,557.52
3	Demolition & Site Preparation	ls	1	$6,380.53	$ 6,380.53
	Demolition				
4	Pavement removal and Over Excavate Deep Patch	sy	91	$ 25.00	$ 2,283.33
5	Saw Cut Existing Pavement for Deep Patch	lf	140	$ 1.90	$ 266.00
6	Cold Pane/Grind Pavement Removal (2 inches deep)	sy	3889	$ 3.00	$ 11,666.67
	Roadway Improvements				
7	Surface Treatment Seal Cracks	sy	4400	$ 3.00	$ 13,200.00
8	2"AC Pavement Overlay - Level 3 (Everly and Loftus)	sy	4400	$ 14.00	$ 61,600.00
9	4" AC Pavement	sy	30	$ 28.00	$ 840.00
10	Aggregate Base	cy	30	$ 6.00	$ 182.48
11	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
	Striping				
12	12" thermoplastic Stop Bar	lf	12	$ 11.00	$ 132.00
13	Crosswalk thermoplastic Bar	lf	24	$ 20.00	$ 480.00
Construction Subtotal					$ 111,203.59
Geotechnical Investigation					$ 5,000.00
Contingency			20%		$ 22,240.72
Engineering			20%		$ 22,240.72
Administrative			5%		$ 5,560.18
Total Project Cost					**$ 166,245.21**

KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

- REMOVE AND REPLACE PAVEMENT
- GRID AND OVERLAY
- TYPE 2 SLURRY SEAL
- DEEP PATCH
- EXTENTS OF PAVEMENT TO BE REHABILLITATED

GENERAL NOTES

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   STAT. AUTH.: ORS 757.542 THROUGH ORS 757.562 AND ORS 757.993.
3. THE CONTRACTOR SHALL CONTACT 'ONE CALL' FOR UTILITY LOCATES PRIOR TO EXCAVATION. (1-800-332-2344)
4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
11. TREE ROOTS SHALL BE REMOVED TO THE EXTENTS INSTRUCTED BY THE CITY'S REPRESENTATIVE OR ENGINEER. SAW CUT PAVEMENT AND REMOVE TREE ROOT IN PAVEMENT AREA. REBUILD BASE TO MATCH SURROUNDING.
12. IN REMOVE AND REPLACE SECTIONS OF PAVEMENT, SAW CUT DESIGNATED PERIMETER OF PAVEMENT REMOVAL. REPLACE AGGREGATE BASE SUB-GRADE WITH 6-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. MAKE SMOOTH TRANSITION AT ALL EXISTING PAVEMENT EDGES. MATCH TO EXISTING GRADES.
13. PAVEMENT EDGE REMOVAL WILL CONSIST OF REMOVING 1.5 FEET OF PAVEMENT ALONG THE EDGE OF ROAD WHERE NOTED ON PLANS. DEPTH OF PAVEMENT AND BASE REMOVAL WILL BE 16 INCHES. REPLACE THE BASE WITH 12-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. APPLY TACK COAT TO ALL BITUMINOUS SURFACES PRIOR TO AC PLACEMENT.
14. PROTECT INLETS AND CATCH BASINS IN AND DOWNSTREAM FROM CONSTRUCTION AREAS PRIOR TO WORK.
15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1/C2 EVERLY STREET AND MAIN STREET

PLAN SCALE

50 0 25 50 100

1"=100'

N

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
Coos Bay, Oregon 97420
541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC | Drawn By: MKC | Checked By: MDW

Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

EVERLY STREET AND MAIN STREET

Sheet No. C2

Date NOVEMBER 2018

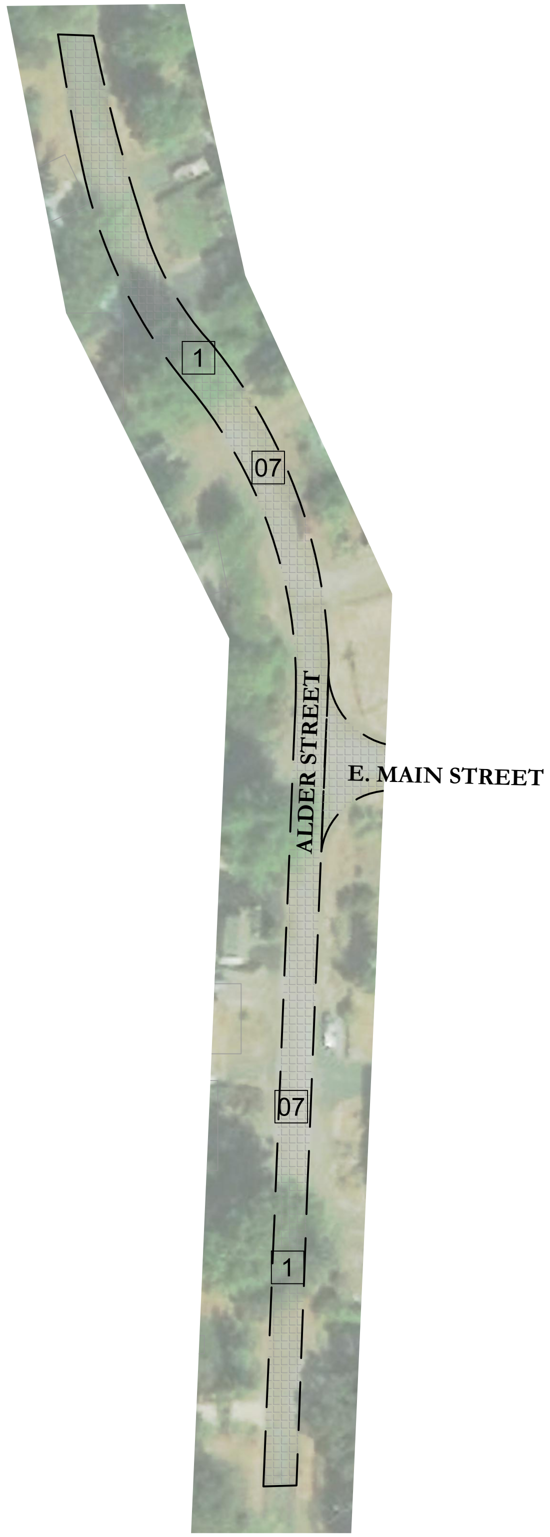
6.3.4 Project 4

This project is on Alder Street. Alder Street runs north and south from West Main Street. Observed pavement distress on Alder includes; longitudinal cracking, oxidation, again and raveling. The most southern portion of Alder Street is identified as less severe than the northern portion.

It is recommended to complete a 2-inch grind and overlay of new asphalt on Alder Street. Prior to completing this project, it is recommended the city compete geotechnical evaluation of the pavement layers to confirm there is a supportive base and subbase layers. If it is found the subbase layers of the pavement are inadequate the city will need to re-evaluate the maintenance method and reconstruction may be required. See the project sheet C3 for more information. Provided below is the overall construction cost estimate for Alder Street improvements totaling **$81,361.83.**

Table 6-4 Alder Street Improvements Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$4,316.67	$ 4,316.67
2	Construction Facilities & Temporary Controls	ls	1	$2,158.33	$ 2,158.33
3	Demolition & Site Preparation	ls	1	$3,021.67	$ 3,021.67
	Demolition				
4	Cold Pane/Grind Pavement Removal (2 inches deep)	sy	1000	$ 6.00	$ 6,000.00
	Roadway Improvements				
5	Surface Treatment Seal Cracks	sy	1667	$ 3.00	$ 5,000.00
6	2" AC Pavement Overlay	sy	1667	$ 14.00	$ 23,333.33
7	Clean Pavement Surface and Apply Top Coat Per 00730 ODOT	sy	1667	$ 5.00	$ 8,333.33
8	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Construction Subtotal					$ 52,663.33
Geotechnical Investigation					$ 5,000.00
Contingency			20%		$ 10,532.67
Engineering			20%		$ 10,532.67
Administrative			5%		$ 2,633.17
Total Project Cost					**$ 81,361.83**



KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

- REMOVE AND REPLACE PAVEMENT
- GRID AND OVERLAY
- TYPE 2 SLURRY SEAL
- DEEP PATCH
- EXTENTS OF PAVEMENT TO BE REHABILLITATED

GENERAL NOTES

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4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
11. TREE ROOTS SHALL BE REMOVED TO THE EXTENTS INSTRUCTED BY THE CITY'S REPRESENTATIVE OR ENGINEER. SAW CUT PAVEMENT AND REMOVE TREE ROOT IN PAVEMENT AREA. REBUILD BASE TO MATCH SURROUNDING.
12. IN REMOVE AND REPLACE SECTIONS OF PAVEMENT, SAW CUT DESIGNATED PERIMETER OF PAVEMENT REMOVAL. REPLACE AGGREGATE BASE SUB-GRADE WITH 6-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. MAKE SMOOTH TRANSITION AT ALL EXISTING PAVEMENT EDGES. MATCH TO EXISTING GRADES.
13. PAVEMENT EDGE REMOVAL WILL CONSIST OF REMOVING 1.5 FEET OF PAVEMENT ALONG THE EDGE OF ROAD WHERE NOTED ON PLANS. DEPTH OF PAVEMENT AND BASE REMOVAL WILL BE 16 INCHES. REPLACE THE BASE WITH 12-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. APPLY TACK COAT TO ALL BITUMINOUS SURFACES PRIOR TO AC PLACEMENT.
14. PROTECT INLETS AND CATCH BASINS IN AND DOWNSTREAM FROM CONSTRUCTION AREAS PRIOR TO WORK.
15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1 / C3 ALDER STREET

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
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541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC | Drawn By: MKC | Checked By: MDW

Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

ALDER STREET

Sheet No. C3

Date NOVEMBER 2018

6.3.5 Project 5

This project consists of two streets, 2nd Street and Cannon Street. 2nd Street runs west to east between Moss Street and Hyland Drive. Cannon Street runs south from 2nd Street. Observed pavement distress on 2nd Street includes; pavement edge cracking/longitudinal cracking, and an aging chip seal. Observed pavement distress on Cannon includes; alligator cracking, longitudinal cracking, oxidation, aging, and severe raveling.

It is recommended to complete a 2-inch grind and overlay of new asphalt pavement on the identified section of Cannon Street and a type two slurry seal on 2nd Street with pavement edge removal/deep patching in identified locations. See the project sheet C4 for more information. Below is the overall construction cost estimate for 2nd Street and Cannon Street improvements totaling **$100,702.62**.

Table 6-5 Cannon And 2nd Street Improvements Cost Estimate

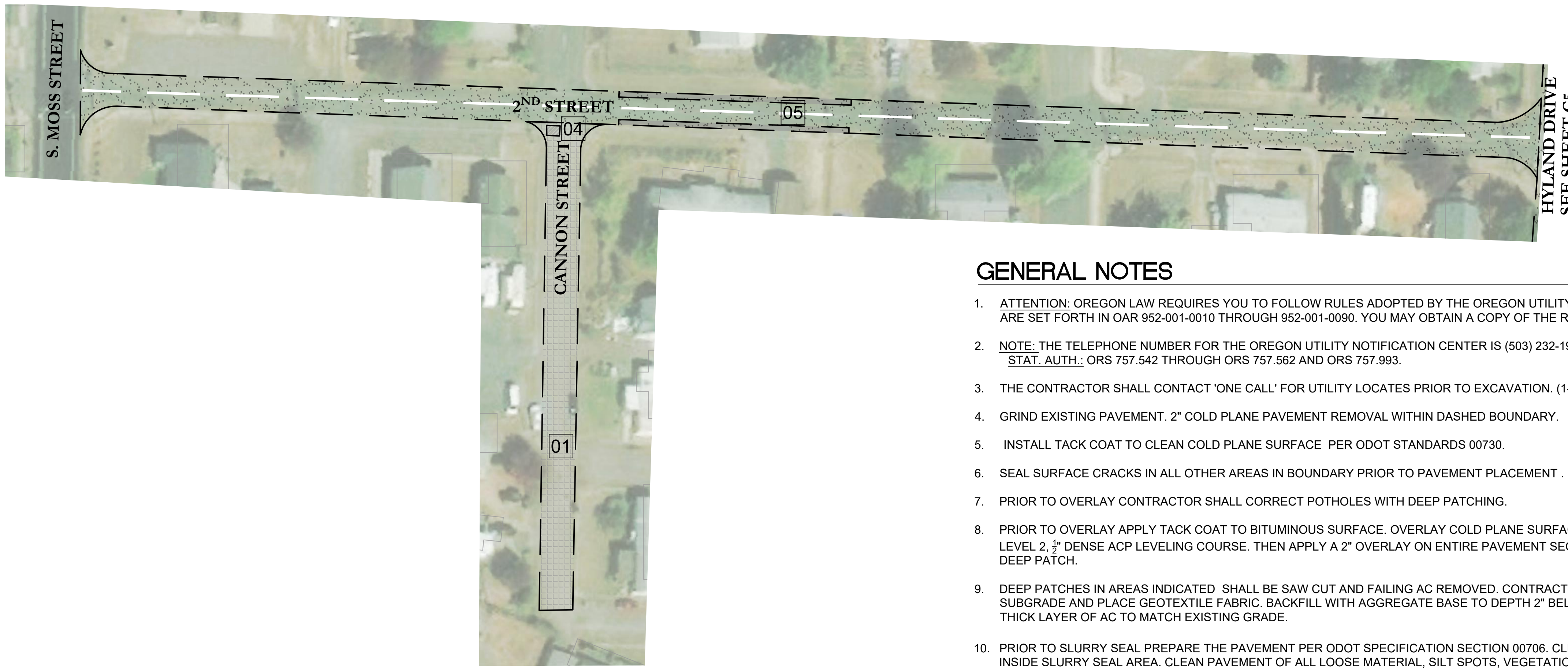
Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$ 5,692.63	$ 5,692.63
2	Construction Facilities & Temporary Controls	ls	1	$ 2,846.31	$ 2,846.31
3	Demolition & Site Preparation	ls	1	$ 3,984.84	$ 3,984.84
	Demolition				
4	Edge Roadway Section Removal 1'-6" Width	sy	144	$ 25.00	$ 3,611.11
5	Sawcut existing Concrete, Sidewalks, & Pavement	lf	700	$ 1.90	$ 1,330.00
6	Pavement Removal Deep Patch Over Excavate	sy	7	$ 25.00	$ 183.33
7	Cold Pane/Grind Pavement Removal (2" deep)	sy	1000	$ 3.00	$ 3,000.00
	Roadway Improvements				
8	Surface Treatments (Seal cracks)	sy	3822	$ 3.00	$ 11,466.67
9	2" AC Pavement Overlay	sy	1000	$ 14.00	$ 14,000.00
10	Type 2 Slurry Seal	sy	2822	$ 5.00	$ 14,111.11
11	4" AC - 2' wide edge reconstruction	sy	74	$ 28.00	$ 2,074.07
12	Clean Pavement Surface and Apply Top Coat Per 00730 ODOT	sy	1000	$ 5.00	$ 5,000.00
13	Reconstruct sub-base on the edge of roadway and deep patch 3/4-0" rock	cy	50	$ 3.00	$ 150.00
14	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Striping					
14	4" White Dotted Line Per ODOT TM500 WD	lf	1000	$ 1.50	$ 1,500.00
Construction Subtotal					$ 69,450.08
Contingency			20%		$ 13,890.02
Engineering			20%		$ 13,890.02
Administrative			5%		$ 3,472.50
Total Project Cost					**$100,702.62**

KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

- REMOVE AND REPLACE PAVEMENT
- GRID AND OVERLAY
- TYPE 2 SLURRY SEAL
- DEEP PATCH
- EXTENTS OF PAVEMENT TO BE REHABILLITATED



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4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
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12. IN REMOVE AND REPLACE SECTIONS OF PAVEMENT, SAW CUT DESIGNATED PERIMETER OF PAVEMENT REMOVAL. REPLACE AGGREGATE BASE SUB-GRADE WITH 6-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. MAKE SMOOTH TRANSITION AT ALL EXISTING PAVEMENT EDGES. MATCH TO EXISTING GRADES.
13. PAVEMENT EDGE REMOVAL WILL CONSIST OF REMOVING 1.5 FEET OF PAVEMENT ALONG THE EDGE OF ROAD WHERE NOTED ON PLANS. DEPTH OF PAVEMENT AND BASE REMOVAL WILL BE 16 INCHES. REPLACE THE BASE WITH 12-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. APPLY TACK COAT TO ALL BITUMINOUS SURFACES PRIOR TO AC PLACEMENT.
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15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1 / C4 — 2ND STREET AND CANNON STREET

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

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REV.	DATE	DESCRIPTION	BY

Designed By: MKC · Drawn By: MKC · Checked By: MDW · Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

2ND STREET AND CANNON STREET

Sheet No. C4

Date NOVEMBER 2018

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

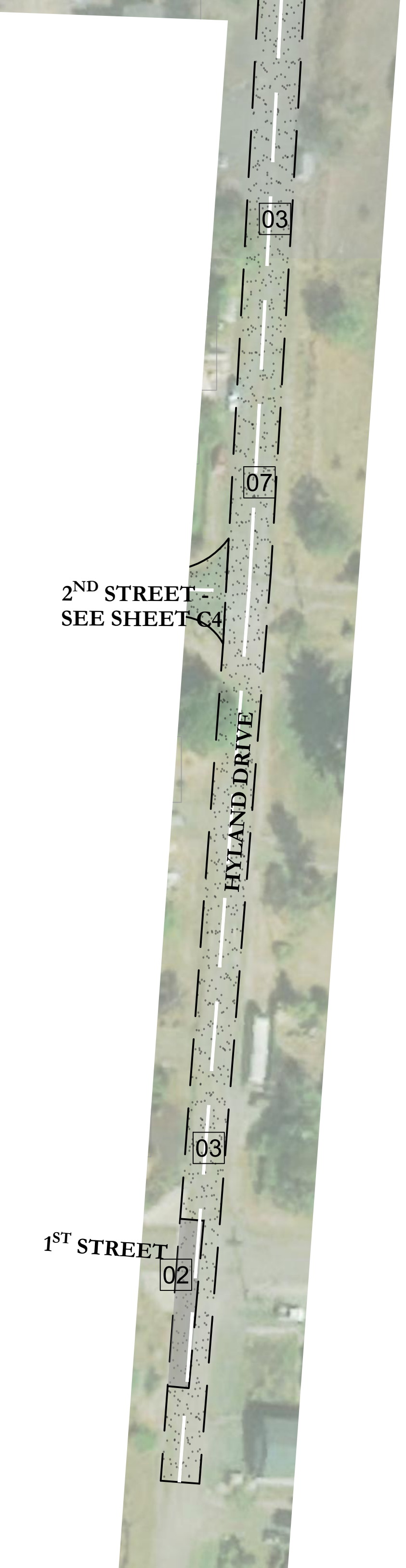
6.3.6 Project 6

This project consists of two streets, 3rd Street and Hyland Drive. Hyland Drive runs north and south on the most eastern side of 3rd Street. 3rd street runs west from Hyland Drive. Observed pavement distress on Hyland Drive includes; alligator cracking, longitudinal cracking, minimal raveling. 3rd street is in good condition and observed pavement distress include minimal cracking and pavement flexibility loss.

Due to the good condition of the pavement and no major visible distress on 3rd Street, it is recommended to complete crack sealing prior to completing a type 2 slurry seal. This will give back some pavement flexibility and prolong the life of the pavement structure. Also, It is recommended to complete a type 2 slurry seal and deep patching on Hyland Drive. See sheet C5 for more information. Below is the overall construction cost estimate for 3rd Street and Hyland Drive improvements totaling **$101,401.24**.

Table 6-6 3rd Street and Hyland Drive Improvement Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$ 5,732.12	$ 5,732.12
2	Construction Facilities & Temporary Controls	ls	1	$ 2,866.06	$ 2,866.06
3	Demolition & Site Preparation	ls	1	$ 4,012.49	$ 4,012.49
Demolition					
4	Pavement Removal and Over Excavate Deep Patch	sy	122	$ 25.00	$ 3,055.56
5	Saw Cut Pavement	lf	210	$ 1.90	$ 399.00
Roadway Improvements					
6	Surface Treatments (Seal cracks)	sy	6044	$ 3.00	$ 18,133.33
7	Type 2 Slurry Seal	sy	6044	$ 5.00	$ 30,222.22
8	4" AC Pavement - Level 3	sy	122	$ 14.00	$ 1,711.11
9	Aggregate base rock	cy	50	$ 6.00	$ 300.00
10	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Striping					
11	4" White Dotted Line Per ODOT TM500 WD	lf	2000	$ 1.50	$ 3,000.00
Construction Subtotal					$ 69,931.89
Contingency			20%		$ 13,986.38
Engineering			20%		$ 13,986.38
Administrative			5%		$ 3,496.59
Total Project Cost					**$101,401.24**



KEYED NOTES

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02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
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07	CRACK SEALING

HATCH LEGEND

- REMOVE AND REPLACE PAVEMENT
- GRID AND OVERLAY
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15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1 / C5 — 3RD STREET AND HYLAND DRIVE

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
Coos Bay, Oregon 97420
541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC
Drawn By: MKC
Checked By: MDW
Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

3RD STREET AND HYLAND DRIVE

Sheet No. C5

Date NOVEMBER 2018

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

6.3.7 Project 7

This project is on 4th Street. 4th Street runs west and east one block north of 3rd Street. This street is mostly in good condition. The most eastern section of 4th Street has a partial section with older pavement and tree root intrusion. Observed types of distress include; raveling, oxidation, alligator cracking, and tree root intrusion.

It is recommended to complete crack sealing and a type 2 slurry seal on the entire section of 4th street to maintain the road. It is assumed the road was constructed 10 or more years ago. A slurry seal will create one continuous surface to the somewhat patchy road on the eastern portion and extend the life of the pavement. The section identified on sheet C6 should be corrected with deep patch prior to the slurry seal. This will correct subbase damage due to the tree root intrusion. See Sheet C6 for more information. Below is the overall construction cost estimate for 4th Street improvements totaling **$52,931.62**.

Table 6-7 4th Street Improvement Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$ 2,992.18	$ 2,992.18
2	Construction Facilities & Temporary Controls	ls	1	$ 1,496.09	$ 1,496.09
3	Demolition & Site Preparation	ls	1	$ 2,094.52	$ 2,094.52
	Demolition				
4	Pavement Removal and Over Excavate Deep Patch	sy	13	$ 25.00	$ 333.33
5	Saw Cut Pavement	lf	100	$ 1.90	$ 190.00
	Roadway Improvements				
4	Surface Treatments (Seal cracks)	sy	3556	$ 3.00	$10,666.67
5	Type 2 Slurry Seal	sy	3556	$ 5.00	$17,777.78
6	4" AC Pavement- Level 3	sy	13	$ 28.00	$ 364.00
7	Aggregate Base	cy	15	$ 6.00	$ 90.00
8	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Construction Subtotal					$36,504.57
Contingency			20%		$ 7,300.91
Engineering			20%		$ 7,300.91
Administrative			5%		$ 1,825.23
Total Project Cost					**$52,931.62**

KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

REMOVE AND REPLACE PAVEMENT

GRID AND OVERLAY

TYPE 2 SLURRY SEAL

DEEP PATCH

EXTENTS OF PAVEMENT TO BE REHABILLITATED

GENERAL NOTES

1. ATTENTION: OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH 952-001-0090. YOU MAY OBTAIN A COPY OF THE RULES BY CALLING THE CENTER.
2. NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS (503) 232-1987.
   STAT. AUTH.: ORS 757.542 THROUGH ORS 757.562 AND ORS 757.993.
3. THE CONTRACTOR SHALL CONTACT 'ONE CALL' FOR UTILITY LOCATES PRIOR TO EXCAVATION. (1-800-332-2344)
4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
11. TREE ROOTS SHALL BE REMOVED TO THE EXTENTS INSTRUCTED BY THE CITY'S REPRESENTATIVE OR ENGINEER. SAW CUT PAVEMENT AND REMOVE TREE ROOT IN PAVEMENT AREA. REBUILD BASE TO MATCH SURROUNDING.
12. IN REMOVE AND REPLACE SECTIONS OF PAVEMENT, SAW CUT DESIGNATED PERIMETER OF PAVEMENT REMOVAL. REPLACE AGGREGATE BASE SUB-GRADE WITH 6-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. MAKE SMOOTH TRANSITION AT ALL EXISTING PAVEMENT EDGES. MATCH TO EXISTING GRADES.
13. PAVEMENT EDGE REMOVAL WILL CONSIST OF REMOVING 1.5 FEET OF PAVEMENT ALONG THE EDGE OF ROAD WHERE NOTED ON PLANS. DEPTH OF PAVEMENT AND BASE REMOVAL WILL BE 16 INCHES. REPLACE THE BASE WITH 12-INCHES OF 3/4-0" MINUS ROCK AND 4-INCHES OF ASPHALT APPLIED IN TWO 2-INCH LIFTS. APPLY TACK COAT TO ALL BITUMINOUS SURFACES PRIOR TO AC PLACEMENT.
14. PROTECT INLETS AND CATCH BASINS IN AND DOWNSTREAM FROM CONSTRUCTION AREAS PRIOR TO WORK.
15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1 / C6 — 4TH STREET

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
Coos Bay, Oregon 97420
541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC | Drawn By: MKC | Checked By: MDW

Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

4TH STREET

Sheet No. C6

Date NOVEMBER 2018

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

6.3.8 Project 8

This project is on West Lakeview Avenue. West Lakeview Avenue is a dead-end residential road that runs west off S. Moss Street. Observed pavement distress on W. Lakeview includes; severe alligator cracking, severe raveling, oxidation, longitudinal cracking, and tree root intrusion.

Due to the severity of the pavement condition and unknown structural capacity of the base and subbase, it is recommended to either complete core samples on this street prior to any major improvements or remove and replace the entire pavement and subbase section. See sheet C7 for more project information. Below is the overall construction cost estimate for W. Lakeview Avenue, including geotechnical investigation totaling **$132,136.06.**

Table 6-8 West Lakeview Improvement Cost Estimate

Item	Description	Unit	Est. Quantity	Unit Amount	Total
1	Mobilization - Bonds & Insurance	ls	1	$ 7,186.89	$ 7,186.89
2	Construction Facilities & Temporary Controls	ls	1	$ 3,593.44	$ 3,593.44
3	Demolition & Site Preparation	ls	1	$ 5,030.82	$ 5,030.82
	Demolition				
4	Tree Root Removal	ls	1	$ 1,000.00	$ 1,000.00
5	Pavement Removal and Over Excavate Deep Patch	sy	1111	$ 25.00	$ 27,777.78
6	Saw Cut Existing Pavement	lf	200	$ 1.90	$ 380.00
	Roadway Improvements				
7	4" AC Pavement - Level 3 Deep patch	sy	1111	$ 28.00	$ 31,111.11
8	6" aggregate Base	cy	1850	$ 6.00	$ 11,100.00
9	Landscape Restoration & Cleanup	ls	1	$ 500.00	$ 500.00
Construction Subtotal					$ 87,680.04
Geotechnical Investigation					$ 5,000.00
Contingency			20%		$ 17,536.01
Engineering			20%		$ 17,536.01
Administrative			5%		$ 4,384.00
Total Project Cost					**$132,136.06**

KEYED NOTES

01	GRIND AND OVERLAY, SEE SHEET NOTES 4-8
02	REMOVE AND REPLACE PAVEMENT, SEE SHEET NOTE 12
03	SLURRY SEAL, SEE SHEET NOTE 10
04	DEEP PATCH, SEE SHEET NOTE 9
05	REMOVE AND REPLACE PAVEMENT EDGE , SEE SHEET NOTE 13
06	REMOVE TREE ROOTS, SEE SHEET NOTE 11
07	CRACK SEALING

HATCH LEGEND

REMOVE AND REPLACE PAVEMENT

GRID AND OVERLAY

TYPE 2 SLURRY SEAL

DEEP PATCH

EXTENTS OF PAVEMENT TO BE REHABILLITATED

GENERAL NOTES

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4. GRIND EXISTING PAVEMENT. 2" COLD PLANE PAVEMENT REMOVAL WITHIN DASHED BOUNDARY.
5. INSTALL TACK COAT TO CLEAN COLD PLANE SURFACE PER ODOT STANDARDS 00730.
6. SEAL SURFACE CRACKS IN ALL OTHER AREAS IN BOUNDARY PRIOR TO PAVEMENT PLACEMENT .
7. PRIOR TO OVERLAY CONTRACTOR SHALL CORRECT POTHOLES WITH DEEP PATCHING.
8. PRIOR TO OVERLAY APPLY TACK COAT TO BITUMINOUS SURFACE. OVERLAY COLD PLANE SURFACES AND DEEP PATCHES WITH 2" DEPTH LEVEL 2, $\frac{1}{2}$" DENSE ACP LEVELING COURSE. THEN APPLY A 2" OVERLAY ON ENTIRE PAVEMENT SECTION FOR A TOTAL OF 4" OF AC ON THE DEEP PATCH.
9. DEEP PATCHES IN AREAS INDICATED SHALL BE SAW CUT AND FAILING AC REMOVED. CONTRACTOR SHALL OVER EXCAVATE 6" OF SUBGRADE AND PLACE GEOTEXTILE FABRIC. BACKFILL WITH AGGREGATE BASE TO DEPTH 2" BELOW SURROUNDING PAVEMENT. PLACE 4" THICK LAYER OF AC TO MATCH EXISTING GRADE.
10. PRIOR TO SLURRY SEAL PREPARE THE PAVEMENT PER ODOT SPECIFICATION SECTION 00706. CLEAN AND SEAL CRACKS $\frac{1}{8}$" AND LARGER INSIDE SLURRY SEAL AREA. CLEAN PAVEMENT OF ALL LOOSE MATERIAL, SILT SPOTS, VEGETATION, OIL SPOTS AND OTHER MATERIAL. THEN APPLY TACK COAT AND LET CURE PRIOR TO PLACEMENT OF SLURRY SEAL. ALL SLURRY SEALS SHALL BE TYPE 2, APPLICATION RATE 10-16.7 LBS/SQ.YD. FOR RESIDENTIAL STREETS.
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15. CONTRACTOR SHALL PROJECT ALL STRUCTURES INCLUDING MANHOLES, VALVES, AND OTHER STRUCTURES IN IMPROVEMENT AREA.
16. CONTRACTOR TO FIELD VERIFY EXTENTS OF ALL WORK AREAS PRIOR TO COMMENCING WORK WITH ENGINEER.

1 / C7 WEST LAKE AVENUE

PLAN SCALE

50 0 25 50 100

1"=100'

N

PRELIMINARY

Civil West Engineering Services, Inc.
486 E Street
Coos Bay, Oregon 97420
541-266-8601
www.civilwest.com

REV.	DATE	DESCRIPTION	BY

Designed By: MKC | Drawn By: MKC | Checked By: MDW

Project No: 2101-014

CITY OF LOWELL
LANE COUNTY, OREGON

PAVEMENT PRESERVATION PLAN

WEST LAKEVIEW AVENUE

Sheet No. C7

Date NOVEMBER 2018

DATE:1/22/19 FILE:O:\CW_Projects\2101 Lowell\2101-014 Pavement Preservation and Maintenance Plan\Drawings\Dwg\PAVEMENT PLAN.dwg

6.3.9 Project 9

This project will identify the annual pavement maintenance cost. These costs are based on miles of roadway for each maintenance repair type, and the assumed width of roadway is 30-feet. There is a total of 5 miles of streets paved in the City of Lowell.

Since it is recommended to complete some form of maintenance and the maintenance is intended to extend the life of the pavement 7-10 years, we will utilize the recommended time frame to assess the overall cost per specified distance. Thus, a 30-year time and life cycle will be used to evaluate the cost of maintenance. For reconstruction a 40- year life cycle will be sued assuming the pavement has had proper maintenance to extend the pavement life.

6.3.9.1 Annual Cost for Each Repair Method

- **Crack Sealing:**
  Crack sealing costs $3.00 per square yard of pavement and the city has 87,991 square yards total of pavement, then the overall cost to treat all roads is $263,973.00. If the planning period before a road needs to be reconstructed fully is now 30 years, then this leaves the annual expense for crack sealing to be $8,799.10 per year. Crack sealing should be completed at minimum two times during a pavement life. See table 6-9 at the end of this section for an annual cost of all recommend pavement maintenance.
- **Slurry Seal/Chip Seal:**
  Slurry seal/Chip sealing costs $9.00 per square yard of pavement and the city has total 87,991 square yards total of pavement, then the overall cost to treat all roads is $791,919.00. If the planning period before a road needs to be reconstructed fully is now 30 years, then this leaves the annual expense for slurry/chip seal to be $26,397.30 per year. See table 6-9 at the end of this section for an annual cost of all recommend pavement maintenance.
- **Grind and Overlay:**
  Grind and overlay costs $26.00 per square yard of pavement and the city has total 87,991 square yards total of pavement, then the overall cost to treat all roads is $2,287,766.00. If the planning period before a road needs to be reconstructed fully is now 30 years, then this leaves the annual expense for overlays to be $76,258.87 per year. See table 6-9 at the end of this section for an annual cost of all recommend pavement maintenance.
- **Full Removal and Reconstruction:**
  Remove and replace costs $66.00 per square yard of pavement and the city has total 87,991 square yards total of pavement, then the overall cost to treat all roads is $5,807,406.00. If the planning period before a road needs to be reconstructed fully is now 40 years, then this leaves the annual expense for reconstruction to be $145,185.15 per year. See table 6-9 at the end of this section for an annual cost of all recommend pavement maintenance.

Table 6-9 Annual Maintenance Cost

Annual Maintenance Cost Estimates		
Repiar	**Annual Cost**	
Crack seal	$	17,598.20
Slurry Seal/Chip Seal	$	26,397.30
Grind and Overlay	$	76,258.87
Total Estimated Cost	***$***	***120,254.37***

Table 6-10 Annual Reconstruction Cost

Annual Reconstruction Cost Estimates		
Repiar	**Annual Cost**	
Reconstruction	$	145,185.15
Total Estimated Cost	***$***	***145,185.15***

From table 6-9 above, the annual cost for maintenance is estimated to be **$120,254.37** and the annual reconstruction cost is estimated to be **$145,185.15**. This is a total estimate of **$265,439.52** that should be allocated to pavement preservation per year. The next section of this report will go over a yearly break down of all costs identified herein for the proceeding years.

7 CAPITAL IMPROVEMENT PLAN AND FINANCING OPTIONS

7.1 INTRODUCTION

This section summarizes the prioritization of the pavement preservation projects developed in section 6. These projects will help preserve the transportation system in the City of Lowell and have provided a basis for future planning.

7.2 CIP PROJECT RECOMMENDATIONS

Projects developed in section 6 of this Plan have been prioritized for the CIP to help the City determine which projects are of higher importance. Streets with more severe pavement condition are a higher priority than those in less severe condition. Input from the City also helped to classify priority. All projects should be completed in order to maintain the roadways and add to the life of the existing pavement structures.

Priority 1

Priority 1 projects address sections of the roadway with severe alligator cracking, severe raveling severe oxidation and areas with poor subbase. Priority 1 includes project numbers 1, 2, 3 and 8 outlined in section 6. This includes the improvements on Main Street, Lakeview Street, Everly and Loftus, and W. Lakeview Avenue. These projects should be completed in the next 1- 3 years. It is estimated the total cost to complete these projects is **$559,656.97**. The recommended list of projects is below in Table 7-1.

Table 7-1 Priority 1 CIP Projects

Project No.	Project Location	Total Cost
1	Main Street	$ 119,174.88
2	Lakeview Avenue	$ 166,245.21
3	Everly and Main Street	$ 142,100.82
8	West Lakeview Avenue	$ 132,136.06
Total Estimated Cost for Priority 1 Projects		**$ 559,656.97**

Priority 2

Priority 2 addresses sections of the roadway with moderate alligator cracking, moderate raveling, and aging. Priority 2 includes project numbers 5 and 6 outlined in section 6. This includes improvements on 2nd Street, Cannon Street, 3rd Street, and Hyland Drive. These projects should be completed by year 4. It is estimated the total cost to complete these projects is **$202,103.86**. The recommended list of projects is below in Table 7-2.

Table 7-2 Priority 2 CIP Projects

Project No.	Project Location	Total Cost
5	2nd Street and Cannon Street	$ 100,702.62
6	3rd Street and Hyland Drive	$ 101,401.24
Total Estimated Cost for Priority 2 Projects		**$ 202,103.86**

Priority 3

Priority 3 addresses sections of roadway with less than moderately severe cracking and aging. Priority 3 includes project numbers 4 and 7 outlined in section 6. This includes improvements on Alder Street and 4th Street. These projects should be completed by year 5. It is estimated the total cost to complete these projects is **$134,293.46**. The recommended list of projects is below in Table 7-3.

Table 7-3 Priority 3 CIP Projects

Project No.	Project Location	Total Cost
4	Alder Street	$ 81,361.83
7	4th Street	$ 52,931.62
Total Estimated Cost for Priority 2 Projects		**$ 134,293.46**

The total cost to complete all projects included in the CIP is **$896,054.29.** It is recommended to complete these projects within the next 5 years.

7.3 Planning for the Future

Planning for the future is an essential part of maintaining civil infrastructure. This section will outline the costs associated with future planning for pavement preservation projects and pavement reconstruction.

Table 7-4 Future Planning and Costs

Future Planning						
Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2023-2043**
Total Cost	$ 285,420.08	$ 142,100.82	$ 132,136.06	$ 202,103.86	$ 134,293.46	$ 265,439.52
Project No.	1 & 2	3	8	5 & 6	4,7	9

It is not reasonable for a small community to be able to pay for nearly $300,000 for pavement improvements in one year. It is recommended the City pursue any grant opportunities and start a fund in the City's budget solely for future pavement preservations projects.

APPENDIX A

GEOTECHINAL REPORT

November 21, 2018

Civil West Engineering Services, Inc.
Attn: Ms. Manda Catterlin, E.I.T.
213 Water Ave. NW, Suite 100
Albany, Oregon 97321

Report of
Geotechnical Investigation & Pavement Assessment
City of Lowell Pavement Preservation
East Main Avenue & East Lakeview Avenue
Lowell, Oregon

CGT Project Number G1804905

1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing the results of our geotechnical investigation for the City of Lowell Pavement Preservation project. The project site includes the portions of East Main Avenue and East Lakeview Avenue between South Moss Street and Pioneer Street, as shown on the attached Site Plan, Figure 1. We performed our work in general accordance with CGT Authorization to Proceed & Work Order, dated July 19, 2018. Written authorization for our services was provided on July 24, 2018. Geotechnical findings, conclusions and recommendations for the project were conveyed to our client via e-mail transmittal in late July 2018. This report was prepared to formally present the recommendations for the project.

2.0 PROJECT INFORMATION

CGT developed an understanding of the proposed public street improvements to East Main Avenue (Main) and East Lakeview Avenue (Lakeview) based on our correspondence with our client. The project is in the preliminary stages of planning, but is anticipated to include:

- Rehabilitation of the subject portion of Main, and rehabilitation and widening of the subject portion of Lakeview. We anticipate grades within the existing roadway alignments will be maintained at or very near their existing grades. New pavements will be surfaced with asphalt concrete (AC).
- Installation of appurtenant utilities within each of the roadways.
- Although no stormwater plans have been provided, we anticipate stormwater from new impervious surfaces will be collected and routed to stormwater infiltration facilities near the subject roadways.

3.0 SCOPE OF SERVICES

Our scope of work included the following:

- Contact the Oregon Utilities Notification Center to mark the locations of public utilities at the site within a 20-foot radius of our explorations.
- Explore subsurface conditions within the subject roadways by advancing a total of six pavement cores and six hand auger borings.
- Perform visual condition surveys of the existing pavements within the subject portion of Main and Lakeview.

- Prepare a site plan to include the approximate locations of the explorations performed at the site.
- Perform a structural capacity evaluation of the existing pavement structures within the subject portion of Main and Lakeview in general accordance with Sections 5.3 and 5.4 of the 1993 AASHTO Pavement Design Manual.
- Provide geotechnical recommendations for rehabilitation of existing pavement structures within Main and Lakeview, including surface treatments, grind and inlays, and new pavement sections.
- Provide this written report summarizing the results of the geotechnical investigation.

4.0 SITE DESCRIPTION

The subject portion of East Main Avenue is a two-lane, asphalt-paved roadway that generally runs east to west and is classified as a Minor Collector. The north side of the street is developed with residential and commercial development. The south side of the street is developed with a public school (Lowell High School) and residential properties. The street is relatively level to very gently descending to the west.

The subject portion of East Lakeview Avenue is a narrow asphalt-paved roadway that generally runs east to west and is classified as a Residential Street. The north side of the street is flanked by Lowell High School, while the south side is flanked with residential properties. This street is also relatively level to very gently descending to the west.

Photographs of the two streets taken during our investigation are shown in the attached Appendix A.

5.0 FIELD INVESTIGATION

5.1 Pavement Investigation

A total of six pavement cores (C-1 through C-6) were advanced within the subject roadways on July 26, 2018. The approximate core locations are shown on the Site Plan, attached as Figure 2. The pavement core locations were determined based on measurements from existing site features (e.g. street intersection, driveways, etc.) and should be considered approximate. The cores were advanced using a portable coring machine provided and operated by CTI personnel.

Following the coring, we advanced a hand auger boring within each cored hole to penetrate base rock (where present) and characterize the subgrade soil. The borings (HA-1 through HA-6) were advanced using a manual, 3-inch-diameter, hand auger provided and operated by CGT. Practical refusal was met on coarse-grained clayey gravel (GC) subgrade soil directly below the pavement materials. Upon completion, the borings were loosely backfilled with the cuttings and the core holes were patched with cold patch asphalt.

A qualified member of CGT's geological staff logged the soils observed within the explorations in general accordance with the Visual-Manual Procedure (ASTM D2488). An explanation of this classification system is attached as Figure 3.

5.2 Visual Condition Surveys

CGT engineering staff performed visual condition surveys of the existing pavements within the subject portions of Main and Lakeview in late July 2018. The purpose of the visit was to identify the type, frequency, severity, and location of surface distress (deficiencies) in the existing pavement in accordance with procedures outlined in the 1993 AASHTO Guide for Design of Pavement Structures, (AASHTO) and the 2018 Oregon Department of Transportation Pavement Data Collection Manual (ODOT PDCM). The results of the survey for Main are presented in the attached Appendix B, and the results of the survey for Lakeview are presented in Appendix C.

6.0 SUBSURFACE CONDITIONS

6.1 Pavement Materials

The following table presents an overview of the pavement materials at each sampling location.

Table 1 Pavement Material Thicknesses at Core Locations

Exploration[1]	Location	Pavement Material Thickness (inches)			Subgrade Soils (USCS)[1]
		Asphalt Concrete	Aggregate Base	Sub-Base	
C-1	See Figure 2	3	2	0	Clayey Gravel (GC)
C-2	See Figure 2	3	2	0	Clayey Gravel (GC)
C-3	See Figure 2	8½	0	0	Clayey Gravel (GC)
C-4	See Figure 2	7½	0	0	Clayey Gravel (GC)
C-5	See Figure 2	8	0	0	Clayey Gravel (GC)
C-6	See Figure 2	9½	0	0	Clayey Gravel (GC)

[1] Practical refusal of the manual hand augering equipment was met on the surface of coarse-grained clayey gravel.

6.2 Groundwater

Groundwater was not encountered within the depths explored on July 26, 2018. Groundwater levels are reported at significant depths in the area of the site and not anticipated to be of significance for this project.

7.0 PAVEMENT STRUCTURAL CAPACITY EVALUATION

CGT performed a structural capacity evaluation of the pavement structures within the subject portions of Main and Lakeview using the results of the visual condition surveys and pavement investigation in general accordance with Section 5.3 of the referenced AASHTO manual. The complete results of our evaluation for Main are presented in the attached Appendix B. The complete results of our evaluation for Lakeview are presented in the attached Appendix C.

8.0 GEOTECHNICAL REVIEW & DISCUSSION

8.1 East Main Avenue

As indicated in the attached Appendix B, our analyses indicate the existing pavement structure does not exhibit a structural deficiency for the modeled vehicular traffic[1] over a 20-year design period. Although no structural deficiency was indicated, the pavement exhibits surface deficiencies that, if not mitigated, will inherently become more pronounced from vehicular traffic over time. Further deterioration will reduce the serviceability of the pavement structure to a level that is typically considered unacceptable for users and

[1] Average daily traffic (ADT) for Main and Lakeview was estimated based on tabular values for the respective functional street classification. Methodologies for estimating ESAL values are presented in Appendices B and C.

require a more frequent maintenance cycle than typically expected. Accordingly, we recommend the surface deficiencies be mitigated by conventional "grind-and-inlay", with provision for addressing localized areas exhibiting moderate to severe fatigue cracking by installing deep patches. Geotechnical recommendations for enhancing the existing pavement structure are presented in Section 10.0 of this report.

8.2 East Lakeview Avenue

8.2.1 Eastern 1/4 of Roadway (Approximate)

As indicated in the attached Appendix C, our analyses indicate the existing pavement structure within this portion of Lakeview does not exhibit a structural deficiency for the modeled vehicular traffic[1] over a 20-year design period. Although no structural deficiency was determined, the pavement exhibits surface deficiencies that, if not mitigated, will inherently become more pronounced from vehicular traffic over time. Further deterioration will reduce the serviceability of the pavement structure to a level that is typically considered unacceptable for users and require a more frequent maintenance cycle than typically expected. Accordingly, we recommend the surface deficiencies be mitigated by a conventional "grind-and-inlay". Geotechnical recommendations for enhancing the existing pavement structure are presented in Section 11.1 of this report.

8.2.2 Western 3/4 of Roadway (Approximate)

As indicated in the attached Appendix C, our analyses indicate the existing pavement structure within this portion of Lakeview exhibits a structural deficiency when considering expected vehicular traffic[1] over a 20-year design period. Recognizing the magnitude of the structural deficiency, the prevalence of surface deficiencies (e.g. fatigue cracking, raveling), and relatively minimal thicknesses of existing pavement materials, we recommend the structural deficiency be mitigated by full removal and replacement with a new pavement section. Geotechnical recommendations for new asphalt pavements are presented in Section 11.2 of this report.

9.0 RECOMMENDATIONS: SITE WORK

The following paragraphs present specific geotechnical recommendations for design and construction of pavements associated with the public street improvements described above. The recommendations presented in this report are based on the information provided to us, results of the field investigation, laboratory data, and professional judgment. CGT has observed only a small portion of the pertinent subsurface conditions. The recommendations are based on the assumptions that the subsurface conditions do not deviate appreciably from those found during the field investigation. CGT should be consulted for further recommendations if variations and/or undesirable geotechnical conditions are encountered during construction.

9.1 Site Preparation & Earthwork

9.1.1 Site Stripping

Where present, existing vegetation and rooted soils should be removed from within, and for a 5-foot-margin around, the proposed new roadway and hardscaping areas. Although no explorations were conducted along roadway shoulders, stripping of rooted soils (where present) is anticipated to extend to depths of about ½-foot bgs. The geotechnical engineer or his representative should provide recommendations for actual stripping depths based on observations during site stripping. Stripped vegetation and rooted soils should be transported off-site for disposal, or stockpiled for later use in landscaped areas.

9.1.2 Grubbing

Grubbing of trees and shrubs should include the removal of the root mass and roots greater than 1-inch in diameter. Grubbed materials should be transported off-site for disposal or stockpiled for later use in landscaped areas. Where root masses are removed, the resulting excavation should be properly backfilled with imported granular structural fill in conformance with Section 9.4.2.1 of this report.

9.1.3 Existing Utilities & Below-Grade Structures

All existing utilities at the site should be identified prior to excavation. Abandoned utility lines beneath new pavement and hardscaping features should be completely removed or grouted full. Soft, loose, or otherwise unsuitable soils encountered in utility trench excavations should be removed and replaced with structural fill as described in Section 9.4 of this report. No below-grade structures were encountered in our explorations. If encountered during site preparation, buried structures (i.e. footings, foundation walls, slabs-on-grade, tanks, etc.) should be completely removed and disposed of off-site. Excavations resulting from demolition of existing structures should be backfilled with structural fill as described in Section 9.4 of this report, as needed to achieve design grades.

9.1.4 Erosion Control

Erosion and sedimentation control measures should be employed in accordance with applicable City, County and State regulations regarding erosion control.

9.2 Wet Weather Considerations

For planning purposes, the wet season should be considered to extend from late September to late June. It is our experience that dry weather working conditions should prevail between early July and mid-September. Notwithstanding the above, soil conditions should be evaluated in the field by the geotechnical engineer or his representative at the initial stage of site preparation to determine whether the recommendations within this section should be incorporated into construction.

9.2.1 General

Trafficability of the near-surface clayey gravel (GC) may be difficult, and significant damage to subgrade soils could occur, if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content. Site preparation activities may need to be accomplished using track-mounted equipment, loading removed material onto trucks supported on granular haul roads, or other methods to limit soil disturbance. The geotechnical engineer or their representative should evaluate the subgrade during excavation by probing rather than proof rolling. Soils that have been disturbed during site preparation activities, or soft or loose areas identified during probing, should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 9.4.2.1 of this report.

9.2.2 Geotextile Separation Fabric

We recommend a geotextile separation fabric be placed to serve as a barrier between the prepared fine-grained subgrade and granular fill/base rock in areas of repeated or heavy construction traffic. The geotextile fabric should be in conformance with Section 02320 of the current Oregon Department of Transportation (ODOT) Standard Specification for Construction.

9.2.3 Granular Working Surfaces (Haul Roads & Staging Areas)

Haul roads subjected to repeated heavy, tire-mounted, construction traffic (e.g. dump trucks, concrete trucks, etc.) will require a minimum of 18 inches of imported granular material. For light staging areas, 12 inches of imported granular material is typically sufficient. Additional granular material, geo-grid reinforcement, or cement amendment may be recommended based on site conditions and/or loading at the time of construction. The imported granular material should be in conformance with Section 9.4.2.1 of this report and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. The prepared subgrade should be covered with geotextile fabric prior to placement of the imported granular material. The imported granular material should be placed in a single lift (up to 24-inches deep) and compacted using a smooth-drum, non-vibratory roller until well-keyed.

9.3 Frozen Weather Considerations

For construction that occurs during extended periods of sub-freezing temperatures, the following special provisions are recommended:

- Structural fill should not be placed over frozen ground.
- Frozen soil should not be placed as structural fill.
- Fine-grained (i.e. silty or clayey) soils should not be placed as structural fill during sub-freezing temperatures.

Identification of frozen soils at the site should be in accordance with ASTM D4083-01 “Standard Practice for Description of Frozen Soils (Visual-Manual Procedure)”. The geotechnical engineer can aid the contractor with supplemental recommendations for earthwork that will take place during extended periods of sub-freezing weather, as required.

9.4 Structural Fill

The geotechnical engineer should be provided the opportunity to review all materials considered for use as structural fill (prior to placement). The geotechnical engineer or his representative should be contacted to evaluate compaction of structural fill as the material is being placed. Evaluation of compaction may take the form of in-place density tests and/or proof roll tests with suitable equipment. Structural fill should be evaluated at intervals not exceeding every 2 vertical feet as the fill is being placed. The following table presents recommended guidelines for frequency of density testing (where practical) of various fill designations.

Table 2 Guidelines for Frequency of Density Testing of Structural Fill Materials

Fill Designation	Recommended Frequency of Density Tests[1]	
	Maximum Depth Interval	**Area-Wide**
General Structural Fill (Mass Grading)	Test every 1 vertical foot	At least one density test per every 200 feet of roadway
Utility Trench Backfill	Test every 2 vertical feet	At least one density test per 200 feet of trench line
Pavement Base Rock	Test at surface of section	At least one density test per every 200 feet of roadway

[1]Or as required by the City of Lowell, where applicable.

9.4.1 On-Site Materials – General Use

9.4.1.1 Asphalt Debris

Asphalt debris resulting from the demolition of existing pavements (where slated for removal) can be re-used as structural fill if processed/crushed into material that is fairly well graded between coarse and fine. The processed/crushed asphalt should contain no organic matter, debris, or particles larger than 4 inches in diameter. Moisture conditioning (wetting) should be expected in order to achieve adequate compaction. When used as structural fill, this material should be placed and compacted in general accordance with Section 9.4.2.1 of this report.

9.4.1.2 Poorly Graded Gravel Fill (GP Fill)

Re-use of the on-site, existing gravel fill (base rock) as structural fill is feasible, provided the material is kept clean of organics, debris, and particles larger than 4 inches in diameter. If reused as structural fill, this material should be prepared in general accordance with Section 9.4.2.1 of this report.

9.4.1.3 Clayey Gravel (GC)

Re-use of this soil as structural fill may be difficult because this soil is sensitive to small changes in moisture content and are difficult, if not impossible, to adequately compact during wet weather. We anticipate the moisture content of this soil will be higher than the optimum moisture content for satisfactory compaction. Therefore, moisture conditioning (drying) should be expected in order to achieve adequate compaction. If used as structural fill, this soil should be free of organic matter, debris, and particles larger than 1½ inches. When used as structural fill, this soil should be placed in lifts with a maximum thickness of about 8 inches at moisture contents within –1 and +3 percent of optimum, and compacted to not less than 92 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor).

If the on-site soils cannot be properly moisture-conditioned and/or processed, we recommend using imported granular material for structural fill.

9.4.2 Imported Fill Materials

9.4.2.1 Imported Granular Structural Fill (General Use)

Imported granular fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel that is fairly well graded between coarse and fine particle sizes. The granular fill should contain no organic matter, debris, or particles larger than 4 inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. The percentage of fines can be increased to 12 percent of the material passing the U.S. Standard No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. As a guideline, grading of this material with particles up to about 4 inches in diameter may follow that presented in the following table.

Table 3 Guideline Gradation for Imported Coarse-Grained Granular Fill

Sieve Size	% Passing
4 inches	100
3 inches	88 – 100
¾-inch	70 – 90
U.S. Standard No. 4	40 – 60
U.S. Standard No. 40	20 – 40
U.S. Standard No. 200	Dry Weather: Less than 12
	Wet Weather: Less than 5

Imported granular fill material should be compacted to not less than 95 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). Granular fill materials with high percentages of particle sizes in excess of 1½ inches are considered non-moisture-density testable materials. As an alternative to conventional density testing, compaction of these materials should be evaluated by periodic deflection (proof roll) testing in accordance with ODOT Test Method 158. Proof roll tests should be performed at maximum intervals of every 1 vertical foot as the fill is being placed.

9.4.2.2 Trench Base Stabilization Material

If groundwater is present at the base of utility excavations, trench base stabilization material should be placed. Trench base stabilization material should consist of a minimum of 1 foot of well-graded granular material with a maximum particle size of 4 inches and less than 5 percent material passing the U.S. Standard No. 4 Sieve. The material should be free of organic matter and other deleterious material, placed in one lift, and compacted until well-keyed.

9.4.2.3 Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of granular material as recommended by the utility pipe manufacturer. Trench backfill above the pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. As a guideline, trench backfill should be placed in maximum 12-inch-thick lifts. The earthwork contractor may elect to use alternative lift thicknesses based on their experience with specific equipment and fill material conditions during construction in order to achieve the required compaction. The following table presents recommended relative compaction percentages for utility trench backfill.

Table 4 Utility Trench Backfill Compaction

Backfill Zone	Recommended Minimum Relative Compaction[1]	
	Structural Areas[2]	Landscaping Areas
Pipe Base and Within Pipe Zone	90% ASTM D1557 or pipe manufacturer's recommendation	88% ASTM D1557 or pipe manufacturer's recommendation
Above Pipe Zone	92% ASTM D1557	90% ASTM D1557
Within 3 Feet of Design Subgrade	95% ASTM D1557	90% ASTM D1557

[1] Or as specified by the City of Lowell (where in the public right-of-way).

[2] Includes proposed pavement areas, structural fill areas, exterior hardscaping, etc.

9.4.2.4 Controlled Low-Strength Material (CLSM)

CLSM is a self-compacting, cementitious material that is typically considered when backfilling localized areas. CLSM is sometimes referred to as "controlled density fill" or CDF. Due to its flowable characteristics, CLSM typically can be placed in restricted-access excavations where placing and compacting fill is difficult. If chosen for use at this site, we recommend the CLSM be in conformance with Section 00442 of the most recent, State of Oregon, Standard Specifications for Highway Construction. The geotechnical engineer's representative should observe placement of the CLSM and obtain samples for compression testing in accordance with ASTM D4832. As a guideline, for each day's placement, two compressive strength specimens from the same CLSM sample should be tested. The results of the two individual compressive strength tests should be averaged to obtain the reported 28-day compressive strength. If CLSM is considered for use on this site, the geotechnical engineer should be consulted for site-specific and application-specific recommendations.

10.0 RECOMMENDATIONS: MAIN AVENUE PAVEMENTS

10.1 Pavement Removal

In accordance with Section 9.1 above, we recommend the upper 2 inches (minimum) of the existing, distressed pavement be removed to prepare for placement of a pavement overlay. Pavement removal should be in conformance with Section 00620 of the most recent, ODOT SSC. Asphalt debris should be transferred and disposed off-site.

10.2 Treatment of Surface Deficiencies

10.2.1 Overview

The long-term performance of repairs to surface deficiencies in asphalt pavement is highly dependent on the quality of workmanship. Accordingly, we recommend an experienced, qualified asphalt contractor be retained to repair deficiencies. The contractor is encouraged to follow repair guidelines and procedures presented in the most recent, ODOT Standard Specifications for Construction (ODOT SSC) and the most recent, "Asphalt in Pavement Maintenance" manual developed by the Asphalt Institute (AI). Other resources may be utilized for review of repair procedures. Subject to review of the pavement engineer, the contractor retained for the repair work may present alternative methods than those indicated below.

10.2.2 Fatigue (Alligator) Cracking

We recommend areas exhibiting severe fatigue cracking be repaired as a "deep patch." Sawcutting and removal of existing pavement should extend at least 1-foot into good pavement outside the cracked area. We recommend this form of pavement repair be in conformance with Section 00748 of the most recent, ODOT SSC. If encountered, soft, loose, or otherwise unsuitable subgrade materials should be removed to expose suitably firm subgrade, and brought back to grade with imported granular fill in conformance with Section 9.4.2.1 of this report. We recommend geotextile separation fabric be placed between the prepared subgrade and new base rock. The fabric should be in conformance with Section 9.2.2 of this report.

10.2.3 Longitudinal & Transverse Cracking

For areas exhibiting cracking, we recommend that all cracks exceeding ¼ inch in width be cleaned and sealed with rubber or other elastomeric modified asphalt in conformance with Section 00746 of the most recent, ODOT SSC. As an alternative, to help mitigate the potential for reflective cracking through the asphalt overlay, a pavement overlay geotextile may be considered, in accordance with Table 02320-6 of the most recent, ODOT SSC.

10.3 Overlay

The following is recommended for overlay surface preparation and construction:

- Once repair of surface deficiencies is complete, the surface that is to be overlaid should be thoroughly cleaned. Compressed air should be used for cleaning to remove all loose matter.
- A tack coat should be applied to the cleaned pavement surface in conformance with Section 00730 of ODOT SSC.
- The recommended minimum 2-inch thick overlay section should be placed on the tack coated surface in conformance with the project civil plans. We recommend asphalt pavement consist of Level 2, ½-inch, dense-graded HMAC in conformance with the most recent ODOT SSC, or as specified by the City of Lowell. Minimum lift thickness of HMAC pavement should be 2 inches, or as specified by City of Lowell. Maximum lift thickness of HMAC pavement should be in conformance with Section 00748 of the most recent ODOT SSC, or as specified by City of Lowell. Asphalt pavement should be compacted to at least 91 percent of the material's theoretical maximum density as determined in general accordance with ASTM D2041 (Rice Specific Gravity), or as specified by the City of Lowell.

11.0 RECOMMENDATIONS: LAKEVIEW AVENUE PAVEMENTS

11.1 Eastern 1/4 of Roadway (Approximate)

11.1.1 Pavement Removal

In accordance with Section 8.2.1 above, we recommend the upper 2 inches (minimum) of the existing, distressed pavement be removed to prepare for placement of a pavement overlay. Pavement removal should be in conformance with Section 00620 of the most recent, ODOT SSC. Asphalt debris should be transferred and disposed off-site.

11.1.2 Treatment of Surface Deficiencies

The recommendations presneted in Section 10.2 of this report are appropriate for treatment of deficiencies in East Lakeview Avenue, where present following removal of the upper 2 inches of pavement.

11.1.3 Overlay

The recommendations presneted in Section 10.3 of this report are appropriate for placement of a new asphalt layer in East Lakeview Avenue.

11.2 Western 3/4 of Roadway & Pavement Widening Areas

11.2.1 Subgrade Preparation

After site preparation as recommended above, but prior to placement of structural fill and/or aggregate base, the geotechnical engineer or his representative should observe a proof roll test of the exposed subgrade soils in order to identify areas of excessive yielding. Proof rolling of subgrade soils is typically conducted during dry weather conditions using a fully-loaded, 10- to 12-cubic-yard, tandem-axle, tire-mounted, dump truck or equivalent weighted water truck. Areas that appear too soft and wet to support proof rolling equipment should be prepared in general accordance with the recommendations for wet weather construction presented in Section 9.2 of this report. If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 9.4.2.1 of this report.

Pavement subgrade surfaces should be crowned (or sloped) for proper drainage in accordance with specifications provided by the project civil engineer.

11.2.2 Input Parameters

Design of the HMAC pavement sections presented below were based on the parameters presented in the following table, the AASHTO 1993 "Design of Pavement Structures" manual, and pavement design manuals presented by APAO and ODOT. If any of the items listed need revision, please contact us and we will reassess the provided design sections.

Table 5 Input Parameters Used in HMAC Pavement Design

Input Parameter	Design Value[1]
Pavement Design Life	20 years
Annual Percent Growth	0 percent
Serviceability[2]	4.2 initial, 2.5 terminal
Reliability[2]	75 percent
Standard Deviation[2]	0.49
Drainage Factor[3]	1.0

Input Parameter		Design Value[1]
Resilient Modulus	Subgrade (Native Soils)[4]	8,000 psi
	Crushed Aggregate Base[2]	20,000 psi
Structural Coefficient[2]	Crushed Aggregate Base	0.10
	Asphalt	0.42
Vehicle Traffic[5]	Residential Street	90,000 ESAL
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1 If any of the above parameters are incorrect, please contact us so that we may revise our recommendations, if warranted.
2 Value based on guidelines presented in the ODOT Pavement Design Guide for flexible pavements.
3 Assumes good drainage away from pavement, base, and subgrade is achieved by proper crowning of subgrades.
4 Value selected based on tabular value for clayey gravel subgrade per APAO manual.
5 ESAL = Total 18-Kip equivalent single axle load. Refer to Appendix C for additional discussion.

11.2.3 Recommended Minimum Section

The following table presents the minimum HMAC pavement sections for the traffic load and design life indicated in the preceding table, based on the referenced AASHTO procedures.

Table 6 Recommended Minimum HMAC Pavement Sections (East Lakeview Avenue)

Material	Material Thickness (inches)	
	Dry Weather Construction[1]	Wet Weather Construction[1]
HMAC Pavement	4	4
Aggregate Base	6	6
Granular Sub-Base[2]	Not required	12
Geotextile Separation Fabric	Optional	Placed per Section 9.2.2 of this report
Subgrade Soils	Prepared in conformance with Section 11.2.1 of this report	

[1] Refer to Section 9.2 of this report about the traditional dry and wet seasons in this region.
[2] Please note this layer does not represent a structural layer for the pavement section. Placement of a granular sub-base is recommended to help protect the moisture sensitive subgrade soils from disturbance in wet weather conditions.

11.2.4 HMAC Pavement Materials

We recommend pavement aggregate sub-base consist of durable, relatively well-graded, granular fill in conformance with Section 00641.10.b of the most recent State of Oregon, Standard Specifications for Highway Construction (ODOT SSC), with the following considerations. We recommend the material have a maximum particle size of 4 inches and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Aggregate sub-base should be compacted to not less than 95 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor), or visual equivalent as identified by deflection (proof roll) testing.

We recommend pavement aggregate base consist of dense-graded aggregate in conformance with Section 02630.10 of the most recent ODOT SSC, with the following additional considerations. We recommend the material consist of crushed rock or gravel, have a maximum particle size of 1½ inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. Aggregate base should be compacted to not less than 95 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor).

We recommend asphalt pavement consist of Level 2, ½-inch, dense-graded HMAC in conformance with the most recent ODOT SSC. Asphalt pavement should be compacted to at least 91 percent of the material's theoretical maximum density as determined in general accordance with ASTM D2041 (Rice Specific Gravity), or as specified by the City of Lowell.

12.0 RECOMMENDED ADDITIONAL SERVICES

12.1 Design Review

Geotechnical design review is of paramount importance. We recommend the geotechnical design review take place prior to releasing bid packets to contractors.

12.2 Observation of Construction

Satisfactory earthwork and pavement performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during our subsurface explorations, and recognition of changed conditions often requires experience. We recommend qualified personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report.

We recommend the geotechnical engineer or their representative attend a pre-construction meeting coordinated by the contractor and/or owner. The project geotechnical engineer or their representative should provide observations and/or testing of at least the following earthwork elements during construction:

- Site Stripping
- Subgrade Preparation for Structural Fills & Pavements
- Compaction of Structural Fill & Utility Trench Backfill
- Compaction of Base Rock for New Pavements
- Placement and Compaction of Asphalt Concrete for New Pavements

It is imperative that the owner and/or contractor request earthwork observations and testing at a frequency sufficient to allow the geotechnical engineer to provide a final letter of compliance for the earthwork activities.

13.0 LIMITATIONS & CLOSURE

We have prepared this report for use by the owner and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from our explorations. If subsurface conditions vary from those encountered in our site explorations, CGT should be alerted to the change in conditions so that we may provide additional geotechnical recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process.

The owner/developer is responsible for ensuring that the project designers and contractors implement our recommendations. When the design has been finalized, prior to releasing bid packets to contractors, we recommend that the design drawings and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification. Design review and construction phase testing and observation services are beyond the scope of our current assignment, but will be provided for an additional fee.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Geotechnical engineering and the geologic sciences are characterized by a degree of uncertainty. Professional judgments presented in this report are based on our understanding of the proposed construction, familiarity with similar projects in the area, and on general experience. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared; no warranty, expressed or implied, is made. This report is subject to review and should not be relied upon after a period of 3 years.

▼

We appreciate the opportunity to work with you on this project. Please contact us at 541.345.0289 if you have any questions regarding this report.

Respectfully Submitted,
CARLSON GEOTECHNICAL

REGISTERED PROFESSIONAL ENGINEER
70773PE
OREGON
Jan. 10, 2007
BRAD MICHAEL WILCOX
EXPIRES: 6/30/2020

Brad M. Wilcox, P.E., G.E.
Principal Geotechnical Engineer
bwilcox@carlsontesting.com

Attachments: Site Location, Figure 1
Site Plan, Figure 2
Soil Classification & Terminology, Figure 3
Appendix A: Site Photographs
Appendix B: Pavement Structural Capacity Evaluation (East Main Avenue)
Appendix C: Pavement Structural Capacity Evaluation (East Lakeview Avenue)

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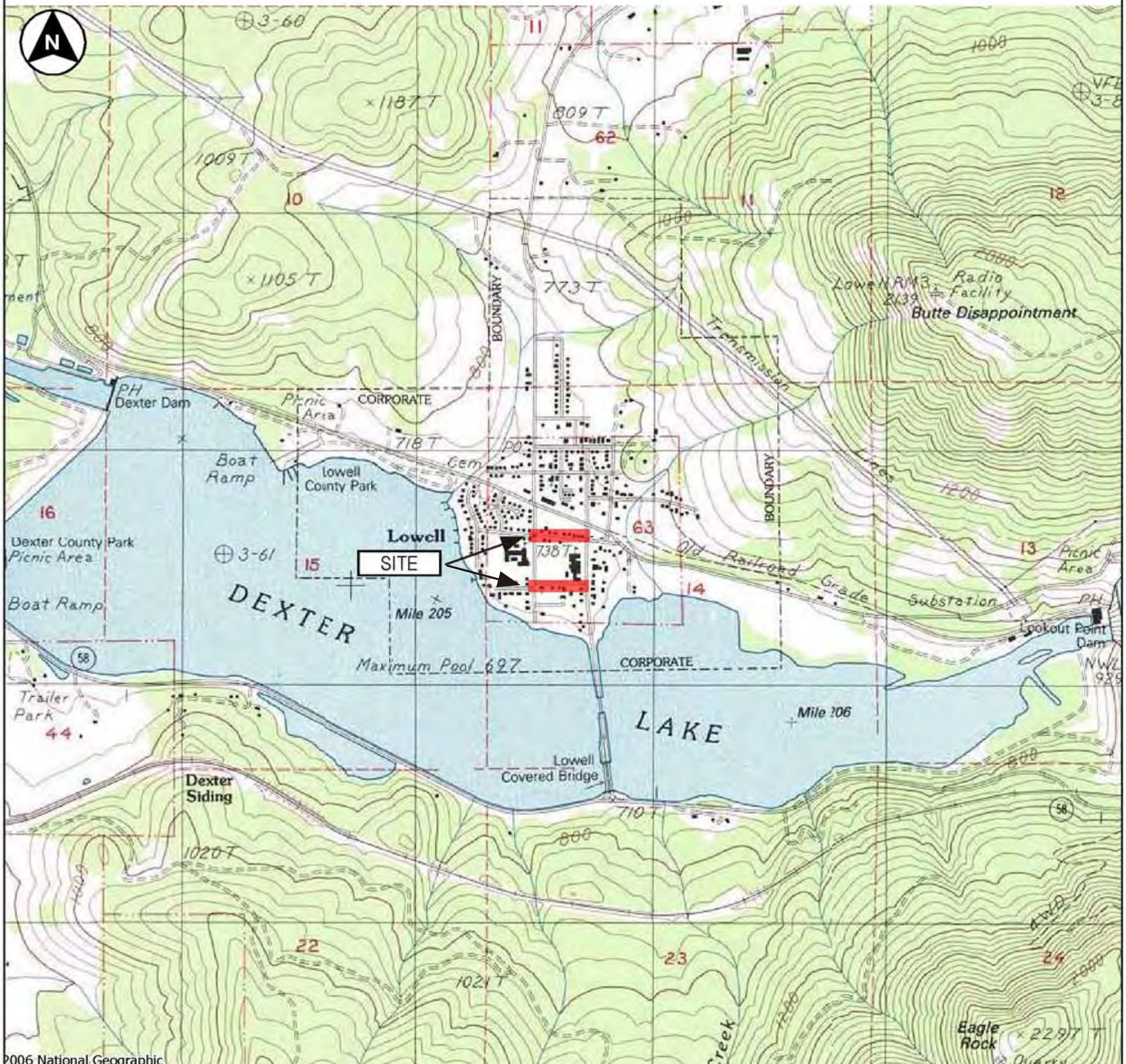
CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON
Project Number G1804905

FIGURE 1
Site Location



Map created with TOPO!™, © 2006 National Geographic Holdings
USGS 7.5 Minute Topographic Map Series, Lowell, Oregon Quadrangle.
Township 19 South, Range 1 West, Section 14 Willamette Meridian

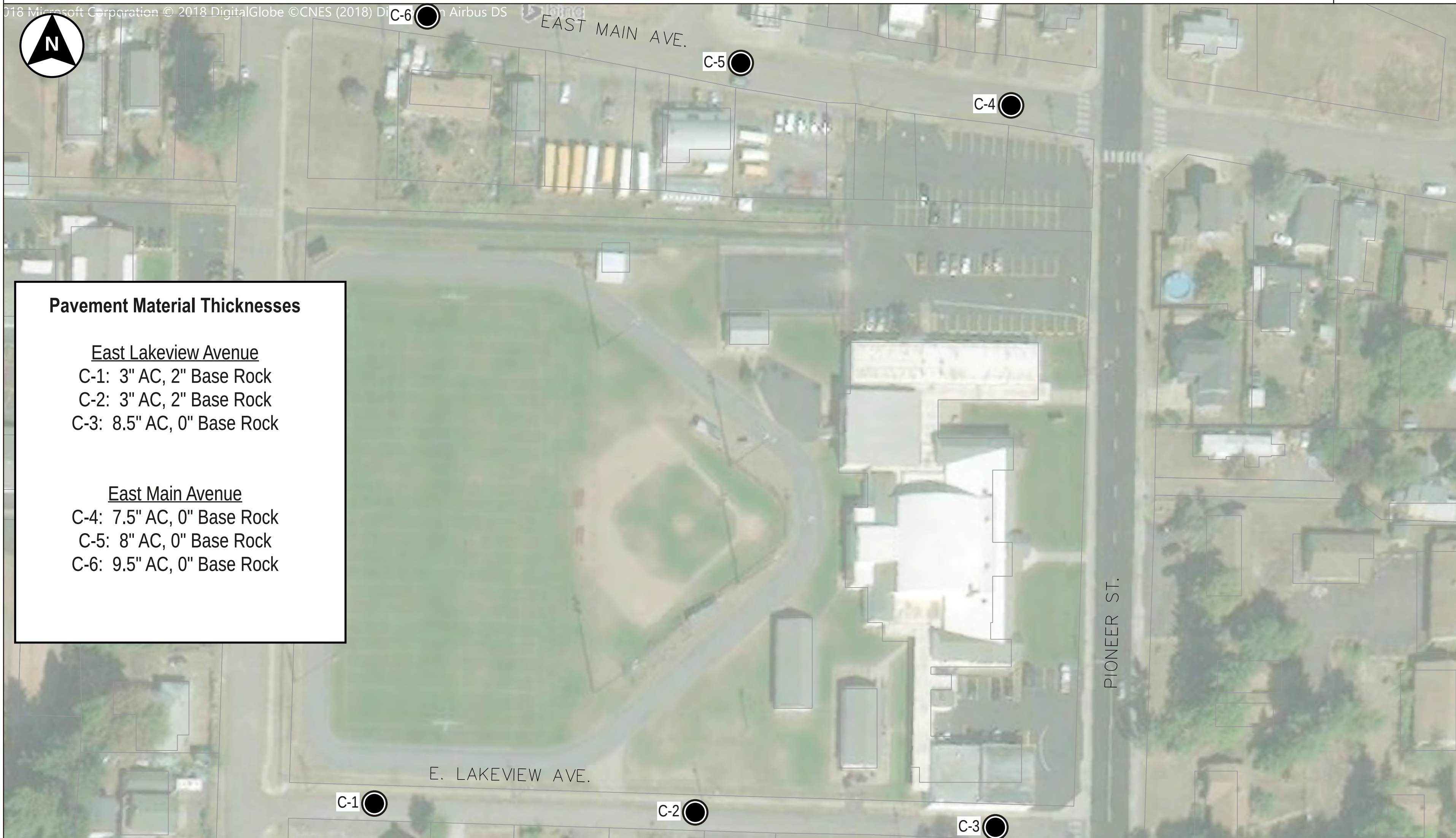
Latitude: 43.917277° North
Longitude: 122.781408° West
1 Inch = 1,000 feet
0 1000 2000

CARLSON CGT GEOTECHNICAL 503-601-8250
Drafted by: MMS

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON
Project Number G1804905

FIGURE 2

Site Plan



Pavement Material Thicknesses

East Lakeview Avenue
C-1: 3" AC, 2" Base Rock
C-2: 3" AC, 2" Base Rock
C-3: 8.5" AC, 0" Base Rock

East Main Avenue
C-4: 7.5" AC, 0" Base Rock
C-5: 8" AC, 0" Base Rock
C-6: 9.5" AC, 0" Base Rock

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: bmw

LEGEND

C-1 ● Pavement core

Approx. Scale: 1 Inch = 120 Feet

0 120 240

NOTES: Drawing based on observations made while on site and site plans provided by Civil West. All exploration locations are approximate.

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON
Project Number G1804905

FIGURE 3
Soil Classification

Classification of Terms and Content

NAME: Group Name and Symbol
Relative Density or Consistency
Color
Moisture Content
Plasticity
Other Constituents
Other: Grain Shape, Approximate Gradation
Organics, Cement, Structure, Odor, etc.
Geologic Name or Formation

Grain Size

Grain Size		U.S. Standard Sieve
Fines		<#200 (0.075 mm)
Sand	Fine	#200 - #40 (0.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75)
Gravel	Fine	#4 - 0.75 inch
	Coarse	0.75 inch - 3 inches
Cobbles		3 to 12 inches
Boulders		> 12 inches

Coarse-Grained (Granular) Soils

Relative Density

SPT N_{60}-Value	Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
>50	Very Dense

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace silt"
5 - 15%	"With" as part of group name	"**POORLY GRADED SAND WITH SILT**"
15 - 49%	Modifier to group name	"**SILTY SAND**"

Fine-Grained (Cohesive) Soils

SPT N_{60}-Value	Torvane tsf Shear Strength	Pocket Pen tsf Unconfined	Consistency	Manual Penetration Test
<2	<0.13	<0.25	Very Soft	Thumb penetrates more than 1 inch
2 - 4	0.13 - 0.25	0.25 - 0.50	Soft	Thumb penetrates about 1 inch
4 - 8	0.25 - 0.50	0.50 - 1.00	Medium Stiff	Thumb penetrates about ¼ inch
8 - 15	0.50 - 1.00	1.00 - 2.00	Stiff	Thumb penetrates less than ¼ inch
15 - 30	1.00 - 2.00	2.00 - 4.00	Very Stiff	Readily indented by thumbnail
>30	>2.00	>4.00	Hard	Difficult to indent by thumbnail

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace fine-grained sand"
5 - 15%	"Some" as part of soil description	"some fine-grained sand"
15 - 30%	"With" as part of group name	"**SILT WITH SAND**"
30 - 49%	Modifier to group name	"**SANDY SILT**"

Moisture Content

Dry: Absence of moisture, dusty, dry to the touch

Moist: Leaves moisture on hand

Wet: Visible free water, likely from below water table

	Plasticity	Dry Strength	Dilatancy	Toughness
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Medium	Medium to High	None to Slow	Medium
MH	Medium to High	Low to Medium	None to Slow	Low to Medium
CH	Medium to High	High to Very High	None	High

Structure

Stratified: Alternating layers of material or color >6 mm thick

Laminated: Alternating layers < 6 mm thick

Fissured: Breaks along definite fracture planes

Slickensided: Striated, polished, or glossy fracture planes

Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown

Lenses: Has small pockets of different soils, note thickness

Homogeneous: Same color and appearance throughout

Visual-Manual Classification

Major Divisions			Group Symbols	Typical Names
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: 50% or more *retained* on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel/sand mixtures, little or no fines
			GP	Poorly-graded gravels and gravel/sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel/sand/silt mixtures
			GC	Clayey gravels, gravel/sand/clay mixtures
	Sands: More than 50% *passing* the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand/silt mixtures
			SC	Clayey sands, sand/clay mixtures
Fine-Grained Soils: 50% or more Passes No. 200 Sieve	Silt and Clays Low Plasticity Fines		ML	Inorganic silts, rock flour, clayey silts
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic soil of low plasticity
	Silt and Clays High Plasticity Fines		MH	Inorganic silts, clayey silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic soil of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

CARLSON CGT GEOTECHNICAL 503-601-8250

References:

ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

Terzaghi, K., and Peck, R.B., 1948, Soil Mechanics in Engineering Practice, John Wiley & Sons.

Carlson Geotechnical

A division of Carlson Testing, Inc.
Phone: (541) 345-0289
Fax: (541) 683-5367

Bend Office	**(541) 330-9155**
Eugene Office	**(541) 345-0289**
Salem Office	**(503) 589-1252**
Tigard Office	**(503) 684-3460**

Appendix A: Site Photographs

City of Lowell Pavement Preservation
East Main Avenue & East Lakeview Avenue
Lowell, Oregon

CGT Project Number G1804905

November 21, 2018

Prepared For:

Civil West Engineering Services, Inc.
Attn: Ms. Manda Catterlin, E.I.T.
213 Water Ave. NW, Suite 100
Albany, Oregon 97321

Prepared by
Carlson Geotechnical

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON
Project Number G1804905

FIGURE A1

Site Plan

<u>LEGEND</u>

1 Orientation of site photographs shown on Figure A2

1 Orientation of site photographs shown on Figure A3

Approx. Scale: 1 Inch = 120 Feet

0 120 240

NOTES: Drawing based on observations made while on site and site plans provided by Civil West. All exploration locations are approximate.

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: bmw

PHOTOGRAPH 1

PHOTOGRAPH 2

Photographs were taken at the time of our fieldwork.

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON
Project Number G1804905

FIGURE A2

Main Avenue Photographs

PHOTOGRAPH 3

PHOTOGRAPH 4

Photographs were taken at the time of our fieldwork.

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: BMW

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON *Project Number G1804905*	**FIGURE A2** **Main Avenue Photographs**

PHOTOGRAPH 5

PHOTOGRAPH 6

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: BMW

Photographs were taken at the time of our fieldwork.

PHOTOGRAPH 7

PHOTOGRAPH 8

Photographs were taken at the time of our fieldwork.

FIGURE A2

Main Avenue Photographs

PHOTOGRAPH 9

PHOTOGRAPH 10

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: BMW

Photographs were taken at the time of our fieldwork.

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON *Project Number G1804905*	**FIGURE A3** **Lakeview Avenue Photographs**

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: BMW

Photographs were taken at the time of our fieldwork.

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON *Project Number G1804905*	**FIGURE A3** **Lakeview Avenue Photographs**

PHOTOGRAPH 3

PHOTOGRAPH 4

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GEOTECHNICAL
503-601-8250
Drafted by: BMW

Photographs were taken at the time of our fieldwork.

CITY OF LOWELL PAVEMENT PRESERVATION - LOWELL, OREGON *Project Number G1804905*	**FIGURE A3** **Lakeview Avenue Photographs**

CARLSON CGT GEOTECHNICAL 503-601-8250

Drafted by: BMW

Photographs were taken at the time of our fieldwork.

PHOTOGRAPH 7

PHOTOGRAPH 8

Photographs were taken at the time of our fieldwork.

Appendix B: Pavement Structural Capacity Evaluation
East Main Avenue

City of Lowell Pavement Preservation
East Main Avenue & East Lakeview Avenue
Lowell, Oregon

CGT Project Number G1804905

November 21, 2018

Prepared For:

Civil West Engineering Services, Inc.
Attn: Ms. Manda Catterlin, E.I.T.
213 Water Ave. NW, Suite 100
Albany, Oregon 97321

Prepared By:

Carlson Geotechnical

B.1 BACKGROUND

Based on information provided by Civil West Engineering, we understand public street improvements are planned for the subject portion[1] of East Main Avenue[2]. In order to estimate the remaining service life of the existing pavement within the subject roadway, and determine if structural enhancements were required to help maintain serviceability, a quantitative evaluation of its structural capacity was performed. We performed the structural capacity evaluation based on visual survey and materials investigation/testing in general accordance with Sections 5.3 and 5.4 of the AASHTO Guide for Design of Pavement Structures, 1993 (AASHTO). The following sections summarize the results of the visual condition survey, the results of our structural capacity analyses, and conclusions for the pavement structure.

B.2 PAVEMENT MATERIALS INVESTIGATION

As indicated in the geotechnical report, CGT advanced three shallow subsurface explorations, including pavement cores and hand auger borings within the existing roadway on July 26, 2018, in order to help refine existing conditions. The results of our completed field investigation were detailed in Section 6.0 of the report, and are briefly summarized below.

Table B1 Pavement Material Thicknesses at Core Locations

Pavement Material	Material Thickness (inches)[1]		
	Core C-4	Core C-5	Core C-6
Asphaltic Concrete	7½	8	9½
Gravel Fill (Aggregate Base Rock)	0	0	0

[1] Thicknesses were determined using a measuring tape and rounded to the nearest ¼ inch.

B.3 VISUAL CONDITION SURVEY

B.3.1 Overview

CGT engineering staff observed surface conditions within the subject street in late July 2018. The Site Plan, Figure A1, presented in Appendix A shows the approximate locations and orientations of the photographs taken during our survey. Photographs taken during our site visit are presented therein on Figure A2. The purpose of the visit was to identify the type, amount, severity, and location of any observed surface distress (deficiencies) in the existing pavement in accordance with AASHTO procedures and the 2018 Oregon Department of Transportation Pavement Data Collection Manual (ODOT PDCM). The following table presents a checklist of typical surface deficiencies in flexible (asphalt) pavement. This table also includes our observations of the presence (lack thereof) of the surface deficiencies within the street.

---

1 This evaluation covers both traffic lanes of East Main Avenue, spanning between South Moss Street and Pioneer Street.
2 Roadway is designated as a Minor Collector per input from Civil West Engineering Services.

Table B2 Pavement Distress Type & Those Observed at Site

Distress Type	Typical Cause(s)	Observed at Site?
Rutting in the wheel paths	Ruts typically develop from consolidation or lateral movement under traffic.	None of significance observed
Fatigue cracking	Typically caused by excessive deflection of the surface over unstable subgrade or lower courses of pavement. The unstable support usually is the result of saturated granular base or subgrade.	Yes, see Section B.3.2 for discussion
Longitudinal/transverse cracking	Typically due to poorly constructed paving joints, shrinkage of asphalt layer, daily temperature cycling, etc.	Yes, see Section B.3.3 for discussion
Patching	Typically used where the original pavement surface is removed and replaced, or additional material is applied to the pavement surface after original construction.	Yes, see Section B.3.4 for discussion
Disintegration (potholes)	Typically caused by weakness in the pavement resulting from insufficient asphalt, failure of base, and/or poor drainage.	Yes, see Section B.3.5 for discussion
Disintegration (raveling)	Typically caused by lack of compaction and/or improper mix proportions.	None of significance observed
Localized Subsidence	Typically caused by poor quality subgrade materials susceptible to consolidation	None observed
Edge cracking	Typically due to lack of lateral (shoulder) support. Another cause of edge cracking can be settlement or yielding of subgrade or granular base.	None observed
Edge joint (seam) "cracking"	Typically due to poor drainage due to a shoulder being higher than the main pavement.	None observed
Corrugations (washboarding)	This form of distress typically occurs in asphalt layers that lack stability due to less than favorable mix proportions.	None observed
Upheaval	Typically caused by expansive soils and/or tree roots.	None observed

B.3.2 Fatigue Cracking

We observed fatigue (alligator) cracking within several areas within the subject street. The cracks were generally ¼- to ½-inch in width and exhibited low to heavy spalling. The severity of fatigue cracking was characterized as "low to severe" in accordance with guidelines presented in the ODOT PDCM. Examples of fatigue cracking are shown on Photographs 2, 4, 6, 8, and 9 on the attached Figure A2.

B.3.3 Longitudinal Cracking

We observed longitudinal cracking within one location within the western portion of the subject street. The crack was generally up to ½ inch in width and is interpreted to be attributed to asphalt shrinkage along a paving joint. The severity of longitudinal cracking was characterized as "low" in accordance with guidelines presented in the ODOT PDCM. A photograph of the longitudinal crack is shown on Photograph 3 on the attached Figure A2.

B.3.4 Patching

We observed two patches within the subject street. The patches were variable in terms of size and footprint, and relatively free of distress within their respective footprints. The severity of patching was characterized as "low severity" in accordance with guidelines presented in the ODOT PDCM. Photographs of the patches are shown on Photographs 6 and 7 on the attached Figure A2.

B.3.5 Disintegration (Potholes)

We observed disintegration (shallow potholes) along the localized edges of the subject street. The potholes are shown on Photographs 4 and 8 on the attached Figure A2. The potholes were generally less than 1 inch deep. The severity of potholes in these areas was characterized as "low" in accordance with guidelines presented in the ODOT PDCM.

B.4 STRUCTURAL CAPACITY EVALUATION

B.4.1 Methodology

We evaluated the structural capacity of the existing pavement structure using the results of the pavement materials investigation and visual survey in general accordance with Section 5.4.5 of AASHTO. The purpose of this evaluation was to determine whether structural enhancement (such as an overlay) was required to help manage anticipated design vehicular traffic. The methodology presented by AASHTO incorporates the use of structural numbers (SN) as follows:

- SN_{eff} = Effective structural number of the existing pavement structure, determined from the visual condition survey and investigation of the existing pavement.
- SN_f = Required structural number for future traffic.
- SN_{ol} = Required overlay structural number. This value is equal to SN_f **-** SN_{eff}. The methodology indicates that, in the event that SN_{eff} is greater than S_f, and no functional deficiencies are observed in the existing pavement, an overlay is not required. Similarly, in the event that SN_{eff} is less than SN_f, an overlay is required to maintain the desired level of serviceability over the indicated design period.

B.4.2 Design Input Parameters

For the purposes of calculating the structural numbers, a number of parameters were estimated based on the results of the visual survey and pavement investigation. In addition, input parameters related to future traffic and level of serviceability were estimated based on guidelines presented in AASHTO and pavement design manuals presented by the ODOT Pavement Design Guide (ODOT PDG)[3] and Asphalt Pavement Association of Oregon (APAO) manual[4]. The parameters used in the evaluation are shown in the following table and are discussed in narrative thereafter.

[3] Oregon Department of Transportation (ODOT) Pavement Design Guide, December 2011.
[4] Asphalt Pavement Association of Oregon (APAO) Asphalt Pavement Design Guide, Revised October 2003.

Table B3 Design Input Parameters

Structural Number	Required Input Parameter	Value Used in Evaluation
SN_{eff}	a_1 = Structural layer coefficient, AC layer	0.30
	a_2 = Structural layer coefficient, base layer	N/A (none encountered)
	a_3 = Structural layer coefficient, subbase layer	N/A (none encountered)
	D_1 = Thickness of existing pavement, surface layer[1]	8
	D_2 = Thickness of existing pavement, base layer[1]	0
	D_3 = Thickness of existing pavement, subbase layer	0
	M_2 = Drainage coefficient for granular base	N/A
	M_3 = Drainage coefficient for granular subbase	N/A
SN_f	N_f = Design period	20 years
	$ESAL_f$ = Design 18-kip ESAL over design period	100,000
	M_R = Design resilient modulus[2]	8,000 psi
	Design Serviceability (PSI) Loss	1.7
	R = Design Reliability	85 percent
	S_o = Design Standard Deviation	0.49

[1]Layer thickness selected based on results of site exploration and represents the location exhibiting the lowest structural number for pavement.
[2]Value selected based on tabular value for clayey gravel subgrade per APAO manual.

The following summarizes additional comments on the values presented in Table B3:

- Layer coefficients (a_1, a_2, and a_3) were determined based on results of visual condition survey discussed in Section B.3 above and Table 5.2 of AASHTO.
- Layer thicknesses (D_1, D_2, and D_3) were based on results of our pavement materials investigation.
- A 20-year design period was assigned for the street in accordance with current standard of practice.
- The design 18-kip ESAL for the street was assigned based on the ESAL presented for the "middle of the road" value for Level III (Low Moderate) Traffic Classification per Table 3.1 of the APAO manual. This traffic classification lists typical ADTT of 7 to 14 per day over 20 years. Examples under this loading consist of urban minor collector streets, rural minor collector streets, and parking lots with more than 500 stalls.
- The value used for design reliability (R) and standard deviation (S_o) was selected in accordance with Table 2A and Section 5.3, respectively, of the referenced ODOT design manual.

B.4.2.1 Results of Analyses

Using the above inputs and procedures presented by AASHTO, we determined the structural numbers for the pavement structure. The following table summarizes the results of our analyses:

Table B4 Calculated Structural Numbers

Area of Interest[1]	Pavement Exploration[1]	Existing Pavement Section (inches)		Calculated Structural Number		
		AC Thickness[1]	Aggregate Base Thickness[1]	SN_{eff}	SN_f	SN_{ol}
East Main Avenue	Core C-5	8	0	2.4	2.4	0

[1] Consistent with Table B3 above.

B.5 REVIEW & DISCUSSION

As indicated above, we completed a structural capacity evaluation of the existing pavement structure within the subject portion of East Main Avenue to determine whether structural enhancement was required to help manage anticipated future vehicular traffic. Our analyses indicated that, for the modeled design ESAL, the effective structural number (SN_{eff}) for the existing pavement is equal to the required future structural number (SN_f) for this street.

Although no structural deficiency was determined, as indicated in Section B.3.1 above, the pavement surface exhibits surface deficiencies that, if not mitigated, will inherently lead to reduced serviceability and require maintenance/repairs at a frequency more common than typically expected. We recommend improvements to the pavement surface be performed to help maintain serviceability over the indicated design period. Recommendations for mitigation of the surface deficiencies are presented in the geotechnical report.

Attachments: None

Appendix C: Pavement Structural Capacity Evaluation
East Lakeview Avenue

City of Lowell Pavement Preservation
East Main Avenue & East Lakeview Avenue
Lowell, Oregon

CGT Project Number G1804905

November 21, 2018

Prepared For:

Civil West Engineering Services, Inc.
Attn: Ms. Manda Catterlin, E.I.T.
213 Water Ave. NW, Suite 100
Albany, Oregon 97321

Prepared By:
Carlson Geotechnical

C.1 BACKGROUND

Based on information provided by Civil West Engineering, we understand public street improvements are planned for the subject portion[1] of East Lakewood Avenue[2]. In order to estimate the remaining service life of the existing pavement within the subject roadway, and determine if structural enhancements were required to help maintain serviceability, a quantitative evaluation of its structural capacity was performed. We performed the structural capacity evaluation based on visual survey and materials investigation/testing in general accordance with Sections 5.3 and 5.4 of the AASHTO Guide for Design of Pavement Structures, 1993 (AASHTO). The following sections summarize the results of the visual condition survey, the results of our structural capacity analyses, and conclusions for the pavement structure.

C.2 PAVEMENT MATERIALS INVESTIGATION

As indicated in the geotechnical report, CGT advanced three shallow subsurface explorations, including pavement cores and hand auger borings, within the existing roadway on July 26, 2018, in order to help refine existing conditions. The results of our completed field investigation were detailed in Section 6.0 of the report, and are briefly summarized below.

Table C1 Pavement Material Thicknesses at Core Locations

Pavement Material	Material Thickness (inches)[1]		
	Core C-1	Core C-2	Core C-3
Asphalt Concrete	3	3	8½
Gravel Fill (Aggregate Base Rock)	2	2	0

[1] Thicknesses were determined using a measuring tape and rounded to the nearest ¼ inch.

C.3 VISUAL CONDITION SURVEY

C.3.1 Overview

CGT engineering staff observed surface conditions within the subject street in late July 2018. The Site Plan, Figure A1, presented in Appendix A shows the approximate locations and orientations of the photographs taken during our survey. Photographs taken during our site visit are presented therein on Figure A3. The purpose of the visit was to identify the type, amount, severity, and location of any observed surface distress (deficiencies) in the existing pavement in accordance with AASHTO procedures and the 2018 Oregon Department of Transportation Pavement Data Collection Manual (ODOT PDCM). The following table presents a checklist of typical surface deficiencies in flexible (asphalt) pavement. This table also includes our observations of the presence (lack thereof) of the surface deficiencies within the street.

---

1 This evaluation covers both traffic lanes of East Lakewood Avenue, spanning between South Moss Street and Pioneer Street.

2 Roadway is designated as a Residential Street per input from Civil West Engineering Services.

Table C2 Pavement Distress Type & Those Observed at Site

Distress Type	Typical Cause(s)	Observed at Site?
Rutting in the wheel paths	Ruts typically develop from consolidation or lateral movement under traffic.	None of significance observed
Fatigue cracking	Typically caused by excessive deflection of the surface over unstable subgrade or lower courses of pavement. The unstable support usually is the result of saturated granular base or subgrade.	Yes, see Section C.3.2 for discussion
Longitudinal/transverse cracking	Typically due to poorly constructed paving joints, shrinkage of asphalt layer, daily temperature cycling, etc.	None observed
Patching	Typically used where the original pavement surface is removed and replaced, or additional material is applied to the pavement surface after original construction.	None observed (utility patch only)
Disintegration (potholes)	Typically caused by weakness in the pavement resulting from insufficient asphalt, failure of base, and/or poor drainage.	Yes, see Section C.3.3 for discussion
Disintegration (raveling)	Typically caused by lack of compaction and/or improper mix proportions.	Yes, see Section C.3.4 for discussion
Localized Subsidence	Typically caused by poor quality subgrade materials susceptible to consolidation	None observed
Edge cracking	Typically due to lack of lateral (shoulder) support. Another cause of edge cracking can be settlement or yielding of subgrade or granular base.	None observed
Edge joint (seam) "cracking"	Typically due to poor drainage due to a shoulder being higher than the main pavement.	None observed
Corrugations (washboarding)	This form of distress typically occurs in asphalt layers that lack stability due to less than favorable mix proportions.	None observed
Upheaval	Typically caused by expansive soils and/or tree roots.	None observed

C.3.2 Fatigue Cracking

We observed fatigue (alligator) cracking within several areas within the subject street. The cracks were generally ¼- to ½-inch in width and exhibited low to heavy spalling. The severity of fatigue cracking was characterized as "low to severe" in accordance with guidelines presented in the ODOT PDCM. Examples of fatigue cracking are shown on Photographs 2, 3, 4, 6, and 7 on the attached Figure A3.

C.3.3 Disintegration (Potholes)

We observed disintegration (shallow potholes) within the east portion of the subject street, resultant of fatigue cracking. The potholes are shown on Photograph 2 on the attached Figure A3. The potholes were generally less than 1 inch deep. The severity of potholes in these areas was characterized as "low" in accordance with guidelines presented in the ODOT PDCM.

C.3.4 Raveling

Raveling was observed within the subject street, most notably within the central and west portions of the pavement. Examples of raveling are shown on Photographs 6, 7, and 8 on the attached Figure A3. The severity of raveling was characterized as "low to severe" in accordance with guidelines presented in the ODOT PDCM.

C.4 STRUCTURAL CAPACITY EVALUATION

C.4.1 Methodology

We evaluated the structural capacity of the existing pavement structure using the results of the pavement materials investigation and visual survey in general accordance with Section 5.4.5 of AASHTO. The purpose of this evaluation was to determine whether structural enhancement (such as an overlay) was required to help manage anticipated design vehicular traffic. The methodology presented by AASHTO incorporates the use of structural numbers (SN) as follows:

- SN_{eff} = Effective structural number of the existing pavement structure, determined from the visual condition survey and investigation of the existing pavement.
- SN_f = Required structural number for future traffic.
- SN_{ol} = Required overlay structural number. This value is equal to SN_f - SN_{eff}. The methodology indicates that, in the event that SN_{eff} is greater than S_f, and no functional deficiencies are observed in the existing pavement, an overlay is not required. Similarly, in the event that SN_{eff} is less than SN_f, an overlay is required to maintain the desired level of serviceability over the indicated design period.

C.4.2 Design Input Parameters

For the purposes of calculating the structural numbers, a number of parameters were estimated based on the results of the visual survey and pavement investigation. In addition, input parameters related to future traffic and level of serviceability were estimated based on guidelines presented in AASHTO and pavement design manuals presented by the ODOT Pavement Design Guide (ODOT PDG)[3] and Asphalt Pavement Association of Oregon (APAO) manual[4]. The parameters used in the evaluation are shown in the following table and are discussed in narrative thereafter.

3 Oregon Department of Transportation (ODOT) Pavement Design Guide, December 2011.
4 Asphalt Pavement Association of Oregon (APAO) Asphalt Pavement Design Guide, Revised October 2003.

Table C3 Design Input Parameters

Structural Number	Required Input Parameter	Value Used in Evaluation	
		West ¾ of Road[1]	East ¼ of Road
SN_{eff}	a_1 = Structural layer coefficient, AC layer	0.20	0.30
	a_2 = Structural layer coefficient, base layer	0.10	N/A
	a_3 = Structural layer coefficient, subbase layer	N/A (none encountered)	
	D_1 = Thickness of existing pavement, surface layer[1]	3	8½
	D_2 = Thickness of existing pavement, base layer[1]	2	0
	D_3 = Thickness of existing pavement, subbase layer	0	0
	M_2 = Drainage coefficient for granular base	1.0	N/A
	M_3 = Drainage coefficient for granular subbase	N/A	N/A
SN_f	N_f = Design period	20 years	
	$ESAL_f$ = Design 18-kip ESAL over design period	90,000	
	M_R = Design resilient modulus[2]	8,000 psi	
	Design Serviceability (PSI) Loss	1.7	
	R = Design Reliability	75 percent	
	S_o = Design Standard Deviation	0.49	

[1] The western ¾ of the roadway is defined as the westernmost 530 feet of Lakeview Avenue.
[2] Layer thickness selected based on results of site exploration and represents the location exhibiting the lowest structural number for pavement.
[3] Value selected based on tabular value for clayey gravel subgrade per APAO manual.

The following summarizes additional comments on the values presented in Table C3:

- Layer coefficients (a_1, a_2, and a_3) were determined based on results of visual condition survey discussed in Section B.3 above and Table 5.2 of AASHTO.
- Layer thicknesses (D_1, D_2, and D_3) were based on results of our pavement materials investigation.
- A 20-year design period was assigned for the street in accordance with current standard of practice.
- The design 18-kip ESAL for the street was assigned based on the ESAL presented for the upper limit (50,000) for Level II (Light) Traffic Classification per Table 3.1 of the APAO manual. This traffic classification lists typical ADTT of 2 to 7 per day over 20 years. Examples under this loading consist of residential streets, rural farm roads, and parking lots of less than 500 stalls. In addition, per input from the civil engineer, we understand the subject street will be subjected to school bus traffic. For the purposes of this evaluation, we modeled an ADT of 8 school busses for the subject street.
- The value used for drainage coefficients (m_n) was selected in accordance with Table 2.4 of the referenced AASHTO manual, based on “good” drainage characteristics of the base and subgrade materials. This quality of drainage was selected based on the unsaturated nature of the pavement materials during our investigation in May 2018.
- The value used for design reliability (R) and standard deviation (S_o) was selected in accordance with Table 2A and Section 5.3, respectively, of the referenced ODOT design manual.

C.4.3 Results of Analyses

Using the above inputs and procedures presented by AASHTO, we determined the structural numbers for the pavement structure. The following table summarizes the results of our analyses:

Table C4 Calculated Structural Numbers

Area of Interest[1]	Pavement Exploration[1]	Existing Pavement Section (inches)		Calculated Structural Number		
		AC Thickness[1]	Aggregate Base Thickness[1]	SN_{eff}	SN_f	SN_{ol}
West ¾ (approx.) of East Lakeview Avenue	Core C-1 & C-2	3	2	0.7	1.75	1.05
East ¼ (approx.) of East Lakeview Avenue	Core C-3	8½	0	2.4	1.75	0

[1] Consistent with Table C3 above.

C.5 REVIEW & DISCUSSION

As indicated above, we completed a structural capacity evaluation of the existing pavement structure within the subject portion of East Lakewood Avenue to determine whether structural enhancement was required to help manage anticipated future vehicular traffic. Our analyses indicated that, for the modeled design ESAL, the effective structural number (SN_{eff}) for the existing pavement is less than the required future structural number (SN_f) in two of the three locations along this traffic lane. Accordingly, the procedures indicate there is structural deficiency in the majority of the existing pavement structure. Recommendations for mitigating the deficiency are presented in the geotechnical report.

Attachments: None